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FIFTEEN VOLUMES,

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AMERICAN PUBLISHER'S NOTICE.

THIS work, although based upon Chambers's Encyclopædia, whose distinguished merit is widely known, differs from it in important respects. It could scarcely be expected that an Encyclopædia, edited and published for a foreign market, would give as much prominence to American topics as American readers might desire. To supply these and other deficiencies the American Editors have inserted about 15,000 titles, arranging the whole, including Chambers's Supplement, in a single alphabet. The total number of titles is now about 40,000. The additions give greater fullness in the departments of biography, geography, history, natural history, and general and applied science. Scrupulous care has been taken not to mutilate or modify the original text of the edition of 1880; no changes have been made except such verbal alterations as are required by the omission of the wood-cuts. The titles of articles from Chambers's Encyclopædia, either from the main work or from the Supplement, are printed in bold-faced type—**AMERICA.** The titles of the American additions, whether of new topics or of enlargements of the old, are printed in plain capitals—AMERICA. Should it appear that an article from the English work and its American continuation disagree in any points, the reader will readily refer the conflicting statements to their proper sources.

The labor of consultation will be much reduced by the catch-words in bold-faced type at the top of the page, being the first and last titles of the pages which face each other; and by the full title-words on the back of the volume, being the first and last titles contained therein.

The word *ante* refers to Chambers's Encyclopædia, as represented in this issue. Whenever the word (*ante*) follows a title in the American additions, it indicates that the article is an enlargement of one under the same title in Chambers's Encyclopædia—usually to be found immediately preceding.

ELECTROTYPED FROM THE
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FIRST-BORN (Heb. *Bekor*, Gr. *prototokos*, Lat. *primogenitus*), in scriptural use, signifies the first male offspring, whether of man or of other animals. By a principle of the Mosaic law, and indeed of the common law of nature, it was established that the firstlings of all the produce of creatures, whether animate or inanimate, were in some sense due to the Creator as a recognition of his supreme dominion. See FIRST-FRUITS. Under the title arising from this recognition are to be classed many observances regarding the first-born of animate beings, whether rational or irrational, which prevailed among eastern nations generally, or which are specially established by the Mosaic law: 1. The first-born male, whether of man or of animals, was devoted from the time of birth to God. In the case of first-born male children, the law required that, within one month after birth, they should be redeemed by an offering not exceeding in value five shekels of silver (Exod. xiii. 13). If the child died before the expiration of thirty days, the obligation of redemption ceased; but if that term were completed, the obligation was not extinguished by the subsequent death of the infant. This redemption took place according to a fixed ceremonial. The first-born male of animals also, whether clean or unclean, was equally regarded as devoted to God. The first-born of clean animals, if free from blemish, was to be delivered to the priests within twelve months after birth, to be sacrificed to the Lord (Deut. xv. 21); nor was it permitted to any but the priests to partake of the flesh of such victims (Num. xviii. 18). If the animal were blemished, it was not to be sacrificed, but to be eaten at home (Deut. xv. 22). The first-born of unclean animals, not being a fit subject for sacrifice, was either to be put to death, or to be redeemed with the addition of one fifth of its value (Lev. xxvii. 27; Num. xviii. 15). If not redeemed, it was to be sold, and the price given to the priests. 2. Primogeniture, both by the patriarchal and by the Mosaic law, had certain privileges attached to it, the chief of which were the headship of the family, and a double portion of the inheritance. Before the time of Moses, however, it was in the power of the father to decide which among all his sons should be considered the first-born. Moses ordained that the right should invariably belong to the first-born in point of time.

Among other nations, considerable variety existed as to the succession of children to the inheritance of their parent. The Greeks, especially the Athenians, excluded the females of a family so rigorously from the inheritance, that in the event of a father dying intestate and without heirs-male of his body, the nearest male kinsman succeeded to the estate. The later Romans, on the contrary, placed daughters on the same footing with sons as to the division of intestate property. The Mohammedans gave the daughters a certain share of the father's estate, but only one-half of that assigned to the sons. All the nations of Germanic descent restricted the succession, especially in land, to heirs-male. But the Visigoths in Spain admitted females, except in certain contingencies.

The rights of the first-born in English and Scotch law are noticed under SUCCESSION, PRIMOGENITURE, etc. In France, the law of primogeniture fell at the revolution, in common with many other relics of the feudal system. How far the results of the change have been beneficial, is still a moot-question among political economists. In the state of Virginia, also, after the American revolution, a similar change took place; and that the change has been in accordance with public opinion in that state may be inferred from the fact, that a parent now commonly makes, by will, the same disposition of his property as that which would be provided by the law itself in the case of his dying intestate.

FIRST-FRUITS (Heb. *reshith*, Gr. *protogennemata* and *aparchai*, Lat. *primitiæ*), that portion of the fruits of the earth and other natural produce, which, by the usage of the Jews and other ancient nations, was offered to God, as an acknowledgment of his supreme dominion, and a thanksgiving for his bounty. Among the Jews, the institution of first-fruits comprised both public and private offerings.

Of the former class, there were three principal offerings: the first was at the opening of the corn-harvest. On the day after the passover Sabbath, the 16th of the month Nisan,

a sheaf of new corn, which was cut and gathered with much solemnity, was carried to the holy place, and there waved before the altar (Lev. xxiii. 5 and foll.); nor was it permitted to commence the harvest-work till after this solemn acknowledgment of the gift of fruitfulness. Again, at the feast of Pentecost, two loaves of leavened bread, made from the flour of the new harvest, were waved, with a similar form of worship, before the altar (Ex. xxxiv. 22). Thirdly, at the Feast of Tabernacles, in the 7th month, was held the great feast of the gathered-in harvest, the final acknowledgment of the bounty of God in the fruits of the year (xxiii. 16).

Besides these public offerings of first-fruits on the part of the entire people, individual Jews were bound to private offerings, each upon his own behalf. 1. A cake of the first dough of the year was to be offered to the Lord (Num. xv. 21). 2. The "first of all the fruits" were to be placed in a basket, and carried to the appointed place, where the basket was to be offered with a prescribed form of words, commemorative of the sojourn of Israel in Egypt, and of his deliverance by the strong hand (Deut. xxvi. 2 and foll.). All these offerings were divided into two classes—the first, which were called *Bicurim*, comprised the various kinds of raw produce, of which, although the law seems to contemplate all fruits, seven sorts only were considered by the Jewish doctors to fall under the obligation of first-fruit offering—viz., wheat, barley, grapes, figs, pomegranates, olives, and dates. The law lays down no rule as to the quantity of the first-fruit offering; and it would be tedious to enter into the many questions regarding it which have been raised by the commentators. It was customary for the offerers to make their oblations in companies of twenty-four, and with a singularly striking and effective ceremonial.

The second class of first-fruit offerings were called *terumoth*, and comprised the produce of the year in the various forms in which it is prepared for human use, as wine, wool, bread, oil, date-honey, dried onions, and cucumbers. As to the quantity of these offerings, and the persons on whom the obligation fell, there are many discussions, for which we must refer to the biblical authorities.

Under the kings, and again after the captivity, much laxity crept into the observance of this practice, which Nehemiah labored to revive in its primitive exactness. Offerings analogous to the Jewish first-fruits became usual very early in the Christian church, as is clear from a passage in Irenæus (*Adv. Hær.*, b. iv. c. 17 and 34); but the extent to which it prevailed, and the amount and general character of the oblation, are exceedingly uncertain. It appears to have been merged in the legal provision established by the emperors.

The mediæval ecclesiastical impost known under the name of *primitiæ*, or first-fruits, and sometimes of *annates* or *annalia*, was entirely different. By the word, in its mediæval and modern sense, is meant a tax imposed by the popes on persons presented directly by the pope to those benefices which, by the canonical rules, or in virtue of privileges claimed by them, fall within the papal patronage. Persons so presented were required to contribute to the Roman see the first-fruits (that is, the income of the first year) of their benefice. During the residence of the popes at Avignon, when the papal necessities compelled the use of every means for eking out a precarious revenue, the impost was sought to be extended to every benefice; and this claim was the subject of many contests, especially in Germany and in England, where the claim, so far as regarded direct papal presentation, had existed from the reign of king John. Henry VIII., by two successive statutes (25 Henry VIII. c. 20, and 26 Henry VIII. c. 3), withdrew the right of first-fruits from the pope, in order to transfer it to the king; and he established a special court for the administration of first-fruits, which, however, was soon disused. In the reign of Anne, the revenues arising from this impost in England were vested in a board, to be applied for the purpose of supplementing the incomes of small benefices (2 Anne, c. 11). A similar change was introduced in Ireland by the 2 Geo. I. c. 15; but in the latter kingdom the payment was entirely abolished by the 3 and 4 Will. IV. c. 27. In France, this tax was abolished by the "pragmatic sanction" enacted at Bourges in 1438, and subsequently by the *concordat* of Leo X. with Francis I. in 1512. In Spain, it ceased partially in the reign of Ferdinand and Isabella, and finally under Charles V. In Germany, it formed one of the first among the *centum gravamina* presented to the emperor in 1521, and the claim ceased altogther from that period.

FIRTH. See Frith.

FISCH, Georges, d.d., b. Switzerland, 1814; pastor at Vevay. He afterwards joined the French evangelical, church and became the successor of Adolphe Monod at Lyons. In 1855, he went to Paris, and became the colleague of Edmond de Pressensé, his brother-in-law. He is a director of the evangelical society of France.

FISCHART, John, a very extraordinary German author, was b. either at Mainz or Strasburg, probably about the year 1545. Regarding his life, we know very little. He was by profession a jurist, but his writings exhibit an immense learning and reading in all the departments of human knowledge. About 1570, he made a journey to England. Towards 1580, he was living at Strasburg in terms of close friendship with the eminent book-printer, Bernhard Jobin. During 1581 and 1582, he was advocate to the imperial chamber at Speier, and in 1585 became bailiff of Forbach, where he probably died about 1590. Of the very numerous writings which appeared 1570–90, partly under his own,

and partly under various fictitious names, about fifty have been proved to be on the whole genuine, though disfigured by interpolations. In respect to others, however, the authorship is doubtful. The original editions of almost all F.'s works are extremely rare, but new ones have recently been published. His most celebrated works are based on foreign models, particularly Rabelais, but there is no servile imitation manifested: a free creative genius works plastically on the materials. To this class belong his *Aller Praktik Grossmutter* (1573), *Affentheurlich Naupengehörliche Geschichtklitterung von U. S. W.* (1575), *Podagrammisch Trostbüchlein* (1577), *Binenkorb des Heyl. Römischen Imenschwarms* (1579), and *Der Heilig Brotkorb* (1580). These writings are wholly satirical. With the most inexhaustible humor, he lashes, now the corruptions of the clergy, now the astrological fancies, the dull pedantry, or other follies, public and private, of the time. Next to these stands the outrageously comic work of F.'s—quite original in its conception—entitled *Flöhatz, Weibertratz* (1574). Essentially different in its homely and simple tone is his *Das glückhafft Schiff von Zürich*, written in verse, and published in 1576 (new edition by Halling, 1829). Similar in point of style are his *Psalmen und Geistliche Lieder* (1576; new edit. Berlin, 1849). The rest of F.'s numerous writings, partly in prose, partly in verse, are of unequal merit, singularly varied in style and contents; the prose works being in general more complete than the poetic. What gives so high a value to F.'s satirical humor, is the warm and genuine feeling which he exhibits for the moral foundations of all public and private life—viz., religion, "fatherland," and the family, a feeling which betrays itself in his wildest mirth. His works are, moreover, one of the richest sources from whence to draw information with regard to the manners of his time. But perhaps the most extraordinary thing about F. is his treatment of the language. No German author can be compared with him, not even Jean Paul Richter himself. He coins new words and turns of expression, without any regard to analogy, but nevertheless displays the greatest fancy, wit, and erudition in his most arbitrary formations. The fullest collection of his writings is in the royal library at Berlin. For a critical account of the investigations concerning F. and his works, see Vilmar in Ersch and Gruber's *Encyclopædie* (s. 1, vol. 5).

FISCHER, Ernst Kuno Berthold, b. Silesia, 1824; graduated at Halle, and taught philosophy at Heidelberg. He has written a number of philosophical works containing delineations of the systems of Descartes, Spinoza, Kant, and Leibnitz. He has also written on Schiller, Shakespeare, and Bacon. Was called to the university of Jena as professor of philosophy.

FISH, a naval term of various application. The *fish* is an apparatus of pulleys employed in dragging the flukes of the anchor towards the bow after it has been hoisted to the cat-head.—*Fish-front*, or *paunch*, is a long piece of oak or fir, convex without, concave within, securely fastened on the injured portion of a sprung mast or yard, to which it imparts rigidity. *Side-fishes* are long pieces of timber dove-tailed on the opposite sides of a made mast, to give it a circular form and the requisite diameter.

FISH, Hamilton, ll.d., b. N. Y., 1808; son of Nicholas, who was an officer of the revolutionary army. He was educated at Columbia college, graduated in 1827, and was admitted to the bar three years afterwards. In 1842, he was elected to congress, and in 1848 was chosen governor of the state of New York. In 1851, he succeeded Daniel S. Dickinson as U. S. senator, and thenceforward acted with the republican party. He was appointed secretary of state in 1869, on the resignation of E. B. Washburne, who went as minister to France, and when Grant became a second time president Fish was reappointed. To him belongs the credit of suggesting the joint high commission with Great Britain in 1871, for the settlement of various difficulties between the two countries, the result of which was embodied in the treaty of Washington, which he was mainly instrumental in forming.

FISH, Nicholas, 1758–1833; b. N. Y., and educated at Princeton, N. J. He studied law, and served in the war of 1776 as aide-de-camp and brigade-major, being promoted before the close of the war to be a lieutenant-colonel. He fought at Saratoga, and commanded a corps at Monmouth; he also served in the expedition against the Indians in 1779, and with La Fayette in 1780, and in 1781 was prominent in the operations which preceded the surrender of Cornwallis. He afterwards occupied important civil offices in his native state, and was an alderman in New York city from 1806, during eleven years. He was also, in 1797, president of the New York society of the Cincinnati.

FISHBURN, William, 1760–1819; he was on the staff of gen. Anthony Wayne at the capture of Stony Point, N. Y.; in the convention which framed the state constitution of South Carolina; afterwards a member of the legislature of that state.

FISH CULTURE. See Pisciculture, *ante*.

FISHER, Alexander Metcalf, 1794–1822; b. Mass.; graduated at Yale college, where he was tutor and professor of mathematics and natural philosophy, 1815–22. He lost his life by shipwreck.

FISHER, George Park, d.d.; b. Mass., 1827; graduated at Brown university and studied theology in Yale, Andover, and in Germany. On return he was appointed professor of divinity in Yale college, and ordained pastor of the college church (Congre-

gational). Still later he was professor of ecclesiastical history in Yale divinity school. He has published *Essays on the Supernatural Origin of Christianity with Special Reference to the Theories of Renan, Strauss, and the Tubingen School;* and *History of the Reformation.* He has extensive learning, earnest convictions, broad views, a candid and impartial judgment. These qualities, joined with an English style at once polished and strong, give him a high place among American writers.

FISHER, JOHN, bishop of Rochester, was b. in 1456 at Beverley, in Yorkshire, educated at Michael House college (now incorporated with Trinity college), Cambridge, where he took his degree in 1491, and of which he became master in 1495. Margaret, countess of Richmond, mother of Henry VII., charmed by the report of his virtues and learning, next appointed him her chaplain and confessor. In 1501, he was elected chancellor of the university; and in 1502, became first Margaret professor of divinity. Two years later, he obtained the bishopric of Rochester. For many years after this appointment, he labored diligently for the welfare of the church and the universities. The reformation of Luther found in him—as might have been expected from his devout ecclesiasticism—a strenuous, if not an able opponent. In 1527, a rupture took place between him and Henry in regard to the divorce of queen Catharine. F. refused to declare the marriage unlawful. From this period, he figures in the politico-religious strifes of his time as a stanch adherent of the papacy. He opposed the suppression of the lesser monasteries in 1529, and the acknowledgment of Henry as head of the church in 1531, and thereby excited the dislike of the party of progress in the English nation. His credulity—many would apply a harsher term—in reference to Elizabeth Barton (q.v.), the "holy maid of Kent," involved him in a still more perilous antagonism to the king. He was imprisoned; and on refusing to take the oath affirming the legality of Henry's marriage with Anne Boleyn, he was committed to the Tower, April 26, 1534, where he was treated with great barbarity. A kind but inconsiderate act of pope Paul III. now hastened the destruction of the old man. His holiness, as a reward of his faithful services, sent him a cardinal's hat in May, 1535. When Henry was informed of this, he exclaimed: "Mother of God! he shall wear it on his shoulders, then; for I will leave him never a head to set it on." His ruin was now certain. He was accused of high treason, and after a brief trial was condemned and executed, 22d June, 1535. F. was one of those unfortunate persons who, with abundance of personal virtues, find themselves opposed to the overwhelming tendencies of the times in which they live.

FISHER, *Mustela pennantii*, a quadruped of the family *mustelidæ*, found in Canada and the United States. The fisher is not often trapped, being very skillful in escaping. It receives its name from its fondness for fish, which it steals cunningly from traps in which it is placed as bait for the pine-marten. It is the largest of martens, being 3 ft. long, inclusive of the tail. In color it is chiefly black, often with gray or brown tints towards the head. It is a fierce nocturnal animal, living chiefly on birds and small quadrupeds. Its fur in winter is good, and is much used in Europe. The black tail was once a favorite ornament to the caps of the Polish Jews.

FISHER, WILLIAM MARK, b. Boston, 1841; a painter of *genre* pictures; studied with George Innis, and in Paris.

FISHERIES. The capture of various kinds of fish for the purpose of trade has always been extensively carried on in maritime countries, and in those which are watered by large rivers; and has been the means in many instances of adding greatly to their prosperity. In Great Britain and Ireland, especially, this pursuit affords remunerative employment to a large proportion of the population, and forms an unequaled nursery for sailors to recruit the royal navy.

The art of capturing fish, like other arts, has been brought only by degrees to its present perfection. In remote ages, fish were caught in the rudest manner by men who lay on the rocks, ready to shoot them with arrows, or transfix them with spears. Even yet, in places which are only partly civilized, fish are taken with blankets or sheepskins; and a roughly made spear, known as a leister, is still used in the country districts of the United Kingdom in the illegal capture of salmon. Advancing intelligence, however, and the use of fish as an article of barter for other kinds of food, soon led to more effective modes of capture. Persons who dwelt on the sea-coast began to exchange fish for animal food killed by the inland hunters, and in this way initiated a commerce which is now represented by a vast amount of capital and enterprise.

The importance of F., as bearing on the food-supplies of nations, inland as well as maritime, and as forming a remunerative outlet for labor, can scarcely be overestimated, more especially as fish has ever been in the greatest demand by all classes of the people, and has been in use for human food from the most remote periods. Previous to the reformation, it was in universal demand in Britain, being the prescribed diet during the fasts appointed by the church.

One great peculiarity of this source of wealth is that, with slight exceptions, the sea-harvest (if we may so call it) is ripened, without trouble or expense for the fisher, who only requires to provide the means of gathering it; and that, under certain regulations, it is free to all comers. River F., except for salmon, are unproductive in Great

Britain; and Lochleven is the only British fresh-water lake the produce of which is marketable.

The principal F. of Great Britain include the capture of salmon, herring, cod, soles, turbot, mackerel, lobsters, oysters, etc. Immense quantities of these are in constant demand; the various lines of railway that branch inland from the coast afford a means of rapid transit, and have in consequence, considerably enhanced the value of sea-produce, much of which was at one time useless for want of sufficiently rapid conveyance to those seats of population where it would have found ready sale. It is affirmed, indeed, by those who have studied the subject, that increased demands, consequent upon improved facilities of transit, have affected the fisheries, and rendered them less productive than formerly. The machinery of capture is being extended every year, and the supplies have now to be brought from greater distances, the shoals frequenting the coast lines being much exhausted by the incessant inroads made upon them by the fishermen.

It is difficult to obtain reliable statistics of the different fisheries. Excepting the government board for Scotland, there is no recognized authority on the subject. The following figures, bearing on the herring-fisheries of Scotland, which are the most important F. of the United Kingdom, are taken from official returns made by the commissioners, and annually laid before parliament. They only represent the quantity of herrings which is "cured;" but immense numbers of that fish are sold fresh, as taken from the sea. The number of barrels cured in 1877 was 847,718, and in 1875, the number was 942,980. If each barrel contained 700 herrings, the number cured in the latter year would be 660,086,000. It would be no exaggeration to say that an equal number would be sold *fresh*. A large number of the barrels were branded by the government inspectors, a sum of £8,729 16*s*. 6*d*. being paid by the curers for this certificate of excellence. The number of boats engaged in the Scotch F. of 1875 was 14,656; the fishermen and boys employed in the fishing numbered 45,082 persons; and the estimated value of the boats and nets employed in the F. is £983,910. The Scottish-cured herrings are sold not only in Great Britain, but in her colonies and foreign countries. At Hamburg and other continental sea-ports, there are merchants who deal largely in cured herrings, and employ agents who annually visit the various British ports to purchase supplies. It is for the satisfaction of these foreign buyers that the "brand" is used; it denotes the quality of the herrings, and prevents one class of herrings being sold for another class that may be inferior. The principal seats of the herring fishery in Great Britain are at Wick, in Caithness-shire, Scotland, and at Yarmouth, in England; but that industry is also carried on at many other places on the British sea-board, and on the coast of Ireland, which is 2,500 m. in extent. It is estimated by the fishery inspectors for Ireland that the total value of the herrings captured in the Irish seas in 1872 would amount to a quarter of a million sterling. Sixty-eight millions of herrings were taken at Howth alone.

A visit to Billingsgate affords the best means of obtaining a proper notion of the food-wealth of the sea, many tons of all kinds of fish being daily distributed from that mart. The average quantities of white fish estimated to pass through Billingsgate in the course of a year are as follows: Haddocks, 3,500,000; whitings, 20,000,000; soles, 100,000,000; cod, 950,000; plaice, 35,500,000; mackerel, 35,000,000. This estimate is only at the best a very rough one, as no machinery exists for gathering such statistics. So great is the demand for white fish throughout the kingdom, that many fishermen run n. to the Orkney islands to obtain them. Most of the cod-smacks carry their cargo alive as far as Gravesend; but they dare not venture further up the Thames, as the fish would not live in its foul waters. The Irish seas are famed for the fine quality of their white fish; the haddocks of Dublin, in particular, have a great reputation, but during late years they have become very scarce. In Scotland, a vast proportion of the haddocks are slightly smoked, and sold as "finnans," which form a well-known breakfast delicacy in all parts of the country. Large quantities of cod and ling are caught, split up, and sold in a dried state. In 1877, the cod, ling, and hake fishery produced 187,200½ cwt. cured in that way, in addition to 8,620 barrels which were pickled. In 1875, the yield was 187,788½ cwt. cured dried, and 11,749½ barrels pickled. The number of fish taken was 5,791,387, being 1,250,298 more than in the previous year. The most valuable white fish, individually considered, is the aldermanic turbot, which brings a high price. The supply of turbot is chiefly derived from Holland, the fishermen of that country making the capture of the turbot and the sole a *spécialité*. Eels are also caught in large quantities at all seasons, and fetch a remunerative price in the London fish-markets. As many as 16,285 boxes of eels are annually sent from Ireland to England. These boxes will each contain on an average 40 lbs. weight, and the price at 6d. per lb. would give a money value equal to the number of boxes. In Scotland, where a prejudice has long existed against that fish, the eel F. are beginning to prove remunerative.

The lobster, being by far the most valuable of the crustacean kind, is most assiduously nursed in ponds, so as always to be ready for market. Mr. Scovell of Hamble, near Southampton, keeps a thousand or two always on hand, and steam-vessels are employed to bring them alive from the most distant parts of the coast: these boats are built exclusively for this purpose, and have immense wells in them to hold the living freight. The lobsters are not at once brought to London, but are kept ready in per-

forated boxes, in various parts of the Thames, to answer the demand as it arises. Norway supplies at least two thirds of our lobsters, the daily consumption of which in Great Britain has been estimated at 60,000. The lobsters taken from the British seas have now to be sought for at greater distances from the shore than formerly—those obtained on the immediate coast being now very small, and technically called "half lobsters;" they do not, of course, yield such a remunerative price as the larger fish. There is also an enormous demand for oysters, and a considerable proportion of our maritime population earn a comfortable livelihood by breeding and dredging them. At Whitstable, in Kent, and at various places in Essex, there are dépôts for sorting and storing oysters. The "spat" is procured and grown in the course of four years into a marketable commodity of much value, the wholesale prices for the various kinds having been doubled between the years 1860 and 1873. The oyster used to be found in great abundance on the Bristish coasts, but some of the natural beds have been so largely drawn upon that they are becoming exhausted. The natural oysters of Ireland are now very nearly dredged up. In America, the oyster is a common mollusk, and notwithstanding a constantly increasing demand, the natural beds are still productive. See OYSTER.

Whilst sea-fisheries are open to all who have the means of working them, salmon-rivers are for the most part private property. The owners of particular streams usually form themselves into an association chiefly for the protection of the fish during the spawning season. The usual method is for the "lairds" to let their fishings to tenants, who are called "tacksmen," and whose interest it is to capture and sell all the fish they can find. The rents obtained are, in some instances, very large, and form a handsome addition to the land-revenues of the proprietors, Before the invention of packing in ice, and previous to the introduction of steam-boats and railways, salmon used to be hawked through the country towns by cadgers at an almost nominal price, whilst it was sometimes sold in the public markets at twopence per pound. When the increased demand for it, created by these facilities of conveyance, caused it to attain its present price, tacksmen were tempted to overfish their streams, and the consequence was the comparative exhaustion of particular rivers; but by the wisdom of the legislature in passing one or two protective acts of parliament, the salmon-fisheries are now proving very remunerative both to lessees and lairds, the fish having again become comparatively plentiful and increased in size. The rental of the river Tay, in 1872, was £17,000. To pay such a rent, and provide for the working expenses of the various fishing-stations, 70,000 salmon and grilse, of the average weight of 10 lbs. each, would require to be captured. See SALMON, PISCICULTURE.

The following statement of the number of boxes of salmon received in London for the year 1872 will afford an index to the value of the British salmon-fisheries. Each box contained 112 lbs. The English rivers include those of Wales:

Scotch	23,028
Irish	5,298
English	2,706
Dutch	952
Norwegian	352
Swedish	964
Total for 1872	33,300
" for 1871	35,275
Decrease	1,975

It is impossible, from the paucity of reliable information, to do more than roughly estimate the amount of capital employed in the British F., or the value of the stock of boats, nets, and other instruments of capture. However, it is certain that the value of the annual produce of British F. of all kinds is not less than £5,000,000.

A semi-official estimate has been very carefully compiled of the supposed total annual value of the F. of Scotland (exclusive of salmon), with the following result:

Herrings	£960,485
Sprats	7,022
Cod and ling	206,201
Haddock and whiting	264,595
Turbot and other flat fish	12,280
Oysters	14,100
Lobsters, etc.	32,269
Muscles and whelks	8,479
Total	£1,505,431

Assuming that as many salmon are eaten in Scotland as are sent to London, that would give us 46,056 boxes of 112 lbs. each; and taking the average price as five pounds per box, the sum, added to the above, would be £230,280, making a grand total of £1,735,-711. No materials exist for forming a detailed estimate of the annual value of the

English coast-fisheries. The Irish sea-fisheries are rapidly declining. In the year 1846, there were nearly 20,000 boats and vessels of various sizes engaged in the Irish F.; but in 1872, the number employed in the fishery was only 8,000. In 1846, the number of men and boys employed in connection with the sea-fisheries of Ireland was 100,000; in 1872, the number shown in the returns was only a little over 31,000. By the year 1875, the numbers had declined to 5,919 boats and 15,000 men and boys.

The food-fisheries of France are now becoming co-extensive with those of Britain, so far as the capture of sea-fish and crustaceans are concerned. A very large number of sardines are annually caught and cured in the French seas, the cure of this little fish being a very remunerative industry at Concarneau and other places. In the cultivation of those less important fishes which thrive best in lakes, canals, and rivers, the French excel us, for while we only cultivate these for purposes of amusement (see ANGLING), the French people make them an article of commerce, and derive considerable sums of money from their sale. At one time, the whole fresh-water F. belonging to France were not of so much value as one of our salmon streams; but by means of artificial cultivation and careful nursing, they have been much increased in value, and, by the care of the government, are being yearly improved. The fresh-water F. of France are of great extent, some of the fishponds in that country being upwards of thirty thousand acres. These F. are all more or less under the control of the government. In Paris, the annual consumption of fish has been estimated to give for each individual 30 lbs. of sea-fish, and 1 lb. of fresh-water fish.

Among the foreign F. most worthy of notice are the river-fisheries of Germany. where the culture of the Danube salmon and other fresh-water fish is assiduously carried on. In the Mediterranean, various kinds of fish are taken, the one of greatest value being the tunny. The anchovy and sardine are also taken in large quantities. An account of the great eel-fishery at the mouth of the Po, on the Adriatic, has already been given in this work. See COMACCHIO. The Dutch are at present as industrious upon the sea as they were at the time when they founded Amsterdam. and a large proportion of the population of Holland are engaged in their F., which are still a source of wealth to that kingdom. The herring, although not taken by the Dutch in such large quantities as formerly, is as carefully cured as ever, Dutch-cured herrings having a great reputation. Excellent salmon are taken in the mouths of the Rhine, many of which are sent to London for sale, as they can be eaten at a time when British salmon cannot be obtained. The Norwegian F. afford large quantities of lobsters and turbots, while from Newfoundland is derived a plentiful supply of cod or ling. The Newfoundland F., which are principally for cod, have existed for upwards of three centuries. Sir Francis Drake was the first person who fished there on behalf of England, and the fish he sent home soon excited a spirit of enterprise in the country, which led to the dispatch of a large number of ships and the extension of the fishery. The island is surrounded by the cod-banks, and the capture and cure of this fish form the staple occupation of the people. In America, immense quantities of shad are bred artificially in order to aid the natural supplies; the "pisciculture" of salmon has also been commenced on a large scale, that fish having become scarce near the seats of great population. See NEWFOUNDLAND.

The oil-fisheries are not so important as they were at one time, the invention of gas and the discovery of other lubricants having rendered us independent of whale oil. The success of the whale-fisheries has also fluctuated so much as to prevent modern capitalists from embarking very largely in the trade. The only novelties that distinguish the whale-fishery of the present day are the introduction of steam-whalers, and, in some instances, of vessels wintering in Greenland; but, with all these advantages, our whalers barely pay their expenses, and the fishery, as compared with former years, exhibits a considerable falling off. The total whaling fleet numbered at one time 159 ships, but to-day it barely amounts to a tenth of that number. The seal is now largely captured for the purpose of obtaining its oil, many thousands being annually killed by British sealers, as many as 15,000 being taken by the men of a single ship. See WHALE, CACHOLOT, SEAL, GREENLAND, etc. The South-sea or sperm-whale fishery is principally in the hands of the Americans, who pursue this branch of commerce most successfully.

The British and Irish sea and salmon F. are, so far, regulated by numerous acts of parliament. It is quite impossible, however, to give a *précis* of all the provisions which the legislature have laid down for promoting and protecting our F., they are so numerous, and many of them quite local. The sea-fisheries are, in effect, free to all who choose to fish; but the salmon is, by use and wont, as also by acts of parliament passed at various times, private property, although the owners of F. have had to submit them, from time to time, to the regulating power of the legislature.

The following is a summary of the leading points of fishery legislation:

From a very early time, statutes have been passed both in England and Scotland for the purpose of protecting the breeding of fish, and preventing the destruction of the spawn or fry. The development of the F. led to a system of advancing public moneys for their encouragement; for this purpose, commissioners were appointed, through whom money was advanced on loan. A treaty was entered into in 1839 between her majesty and the late king of the French, and carried into effect by act of parliament,

concerning the F. in the seas between the British islands and France. By this convention, the limits within which the general right of fishing is exclusively reserved to the subjects of the two kingdoms respectively, are fixed at three miles' distance from low-water mark. In 1854, a similar treaty was concluded regulating, *inter alia*, the common rights of fishery between the British colonies in North America and the United States. The Halifax F. commission constituted under the treaty of Washington (1871) gave in 1877 an award or 5,500,000 dollars to Canada for conceding to Americans the right of fishing in Canadian waters. Fresh fish of British taking, imported in British bottoms, may be landed without report or entry. Persons employed in the F., in such manner and under such circumstances as are laid down in 50 Geo. III. c. 108, are exempted from impressment.

It would be well if the various acts of parliament regulating the F. were codified or arranged in some logical sequence; and the various fishery offices might be consolidated under one governing board, instead of being, as at present, scattered over various public departments, or administered in separate offices.

FISHERIES (*ante*). To the general view in the article *ante* we add some facts concerning American fisheries, their extent and product. The French first learned the value of the Newfoundland fisheries about the beginning of the 16th c., a value that the lapse of 400 years has in no degree diminished. As early as 1517, there were 50 vessels employed off the banks, and 60 years later, 150 vessels were in the business. Near the close of the 16th c., there began a conflict between France and England for the control of the business, which continued for more than 100 years. Treaties were made and boundaries defined at various times, and the two nations shared about equally in the advantages. The revolution of 1789 and Napoleon's wars greatly diminished the French interest in the fisheries, but after the peace of 1815 they prospered, and in recent years as many as 800 vessels and 12,000 men have been employed by the French alone. The Spaniards also worked the American fisheries for a long period in the 16th and 17th centuries, but the decline of their naval power and the sale or loss of their American possessions withdrew them from the field. English fisheries beyond their own waters began nearly a century before the discovery by Columbus. One of the first fruits of that discovery, as continued by Sebastian Cabot, was to interest Englishmen in the Newfoundland seas, because of their wealth in fish. Temporary settlements were made on the island as early as 1522; acts were passed in 1548, and later, to encourage the fishery, and at the commencement of the 17th c., there were 200 or more English vessels in the business every year. At the same time Gosnold found the codfish off the New England coast, and gave its name to Cape Cod. Thenceforward the New England coast fisheries grew into prominence. Of course at this time the "catch" of these great fleets of fishing vessels was useful only in Europe. And it is stated as a remarkable fact that the demand for fish was seriously diminished by the rapid spread of the Protestant reformation. All this time the English government jealously guarded the fisheries, which reached a high stage of prosperity about the end of the 18th century. In 1814, the value of the product was $12,000,000. A few years later the business passed under the control of the colonial authorities, and the distinctive English fishery as a business was ended.

American fisheries began with the settlement of the country, and New England was always foremost in the business. In 1624, the Plymouth colonists sent a cargo of fish to England, followed the next year by two ships laden with fish and furs. About 1670, the Cape Cod fisheries were leased as though they had been public property, and the rents went to the founding of a free school. In 1639, the colonial legislature passed an act to encourage the fishing business, granting to the property and the persons engaged therein certain immunities. Before 1700, exports of fish were made to Italy, Portugal, and Spain of the annual value of $400,000. About 1740, Massachusetts had 400 vessels engaged in fishing. One of the first measures of England to bring New England into obedience in the early stages of the revolution was to deprive the colonies of the right to work the Newfoundland fishery. During the seven years of the war, fishing was neglected for the more profitable business of privateering. Independence having been achieved, one of the articles in the treaty of peace of 1783 provided "that the people of the United States shall continue to enjoy unmolested the right to take fish of every kind on the grand bank and all the other banks of Newfoundland; also in the gulf of St. Lawrence, and at all other places in the sea where the inhabitants of both countries used at any time to fish; and also that the inhabitants of the United States shall have liberty to take fish of every kind on such parts of the coast of Newfoundland as British fishermen shall use, and also on the coasts, bays, and creeks of all other of his Britannic majesty's dominions in America." One of the first ungenerous acts on the part of England, after this specific agreement, was an order in council prohibiting the importation into the British West Indies of fish caught with American hooks. But the United States government answered by imposing duties on foreign-caught fish, and offering bounties for home production. It is needless to go over the many changes, disputes, and arrangements that occurred in the century gone by with regard to the rights and duties of the United States and the British colonies in this matter. They culminated in 1877, in the results arrived at by the "fisheries commission" under the treaty of Washington, sitting at Halifax. There had been no serious trouble about rights and

privileges under the original treaty of peace of 1783, until 1814, when in negotiating the treaty of Ghent the English commissioners took the position that the war (of 1812) had destroyed the treaty of 1783. The American representatives directly opposed this, and insisted that the rights of fishing guaranteed in the original treaty were irrevocable and inalienable. The convention left the question open, and it was not alluded to in the Ghent treaty. The controversy was revived in 1815, and in 1818 an attempt was made to settle it by a convention which granted to citizens of the United States the right to fish in the deep sea, and to dry and cure on British coasts, as by the treaty of 1783, while they renounced all claim to fish within three marine miles of the British coasts, bays, creeks, or harbors; still retaining, however, the right to enter such coasts, bays, etc., for shelter, repairing damages, and purchasing wood. This agreement did not allay the dispute, and the fishery question was embittered by the Canso and headland questions, involving, practically, the right of Americans to fish in the gulf of St. Lawrence, the bay of Fundy, and the bay of Chaleurs. This dispute, so far as it relates to the bay of Fundy, was submitted to arbitration in connection with the seizure of the *Washington*, and was decided in favor of the United States. Angry contentions continued from 1824 to 1854, when the rival claims of New England and the colonists were amicably adjusted by the reciprocity treaty. In 1866, that treaty was abrogated, and the American and Canadian interests were again placed in conflict. Canada, at the instance of the imperial government, adopted a license system, but soon tired of the trouble and expense it entailed. Matters remained in that condition until the treaty of Washington, in 1871, when an attempt was made to settle the dispute definitely. By that instrument the fisheries of both countries were thrown open reciprocally; but, inasmuch as it was asserted by England that the privileges she accorded were of greater value than those given in return, the subject was referred to a commissioner from the United States and one from Great Britain, and a third to be nominated by the emperor of Austria. After a delay of nearly six years the commission was organized, the three arbitrators being Mr. De Forse, sir A. T. Galt, and ex-judge Kellogg of Massachusetts. Judge Foster, assisted by R. H. Dana, jr., and others, had charge of the American case. The interests of Canada were confided mainly to Mr. Doutre, an eminent lawyer of Montreal. The British case was divided into two parts—one concerning Canada, the other Newfoundland. It held, in effect, that the privilege of fishing in American waters is worthless, and claimed an award of $12,000,000 for the use by Americans of the Canadian inshore fisheries for 12 years—the period of treaty—and $2,280,000 for the use of the Newfoundland fisheries. The American case denied substantially these claims. The commissioners awarded Great Britain the sum of $5,500,000, to be paid within a year.

The whale fishery, once an important business for New England, has fallen almost into discontinuance through the scarcity of whales, their oil having been replaced through the discovery and use of the vegetable and mineral oils. In 1852, there were 602 American vessels, total tonnage 208,399, engaged in whaling; at present less than 100 vessels are so employed. The mackerel fishery is important, and is followed along the coast from Chesapeake bay to Newfoundland. Menhaden or mossbunkers are caught in enormous quantities on the coasts of Long Island for the oil to be obtained from them. In the same region millions of this prolific fish are taken to manure land. Herring are found all along the coast; and in the lakes there is a similar fish known as the siscoe. Halibut are caught chiefly in the north Atlantic. The value of river fisheries has of late years greatly increased under the influence of laws regulating the times for taking, and extensive operations in stocking barren or poorly furnished streams. See PISCICULTURE. Shad are always abundant in proper season in the rivers of the middle and eastern states, growing better as they come north. The great lakes furnish white fish, trout, and lake-herring. The rivers of Maine and regions further n abound in salmon. Along the coast the city markets are supplied with black fish, weak-fish, cod, salmon, mackerel, blue fish, eels, porgies, and many other varieties in great abundance. The oyster fisheries all along the Atlantic coast from New England to North Carolina are important in extent and value. The seal fisheries of Alaska are also among the most important of our national resources.

FISHERMAN'S RING, a ring with a seal used since the 13th c. by the popes to stamp certain documents. The impression gives a figure of St. Peter in the act of fishing

FISHER'S ISLAND, near the Connecticut shore at the e. entrance of Long Island sound, once comprised in the territory of Suffolk co., N. Y., but in 1880, by mutual agreement, annexed to Connecticut. It is about 7 m. long, and 1 to ½ wide, and has an area of about 4,000 acres.

FISHES, *Pisces*, the fourth—or, according to Milne-Edwards and some other naturalists (see AMPHIBIA), the fifth—class of vertebrated animals; consisting of creatures which live in water, and accordingly breathe by gills (*branchiæ*), and not, at any stage of their existence, by lungs. In number—both of individuals and of different kinds—they are supposed to exceed all the other classes of vertebrate animals put together Even the water of hot springs and the pools of caverns have their peculiar F., and some of these are only known as thrown out with torrents of muddy water by volcanoes.

The form of F. is generally adapted to easy and rapid progression through water, being more or less nearly that of a spindle, swelling in the middle, and tapering towards

the extremities; the outline unangular, and the surface smooth. But exceptions to this rule are numerous; and some provided with other means of seeking their food, or of preservation from their enemies, exhibit the greatest possible departures from the ordinary shape: some are globe-shaped, some have a most irregular and angular outline, many are much elongated, as eels; and others are compressed and flattened, as flounders.

The bones of F. differ much in their structure from those of other vertebrate animals: they are less dense and compact, and when their ossification is perfect, remain separte, as in the early embryotic state of the *mammalia*. The bones of the sub-class of cartilaginous F. (q.v.), however, never become properly ossified. The bones of F. generally contain a smaller proportion of earthy matter than those of other vertebrate animals, and their cartilaginous basis contains no gelatine strictly so called. The typical character of the vertebrate skeleton is, however, maintained, although modified; and many of the bones—a great majority, for example, of those of the head—are evidently homologous with those of quadrupeds and of man. There is no neck, and the vertebræ are distinguishable only into abdominal and caudal. The vertebræ are concave at each end, and pierced in the middle, the hollow space being occupied with a gelatinous substance. Spinous processes, sometimes short, sometimes long, extend upwards and downwards from the vertebræ to support the muscles. F. also generally have ribs, connected with the abdominal vertebræ; and in many, an additional set of small bones (*epipleural spines*) connected with the ribs, and arising from near the base of the ribs, extends outwards and backwards through the lateral muscles. The four limbs which belong to the typical structure of vertebrate animals, assume in F. the form of *fins* (q.v.), and are generally, although not always, all present, the first pair being the *pectoral*, the second pair the *ventral* fins. In some F., the ventral fins, answering to the hind-feet of quadrupeds, are actually further forward than the pectoral fins, and are then called *jugular* fins. In some, as the common eel, the ventral fins are wanting; in some, as the *murœna*, there are neither pectoral nor ventral fins. Connected with these fins are bones, which show that they represent the limbs of other vertebrate animals. F. have, however, also other fins not so closely connected as these with the internal (*endo-*) skeleton, and not placed like them in pairs towards the sides, but vertically on the middle (*mesial*) line; one or more (*dorsal*) on the back; one or more (*anal*) on the opposite or ventral aspect, behind the anus; and one (*caudal*) at the extremity of the tail. The caudal fin is in general the principal organ of locomotion, and most of the muscles of the body combine to give great energy to its strokes, great part of the body moving with it, and the vertebræ with their processes being so framed as to admit great freedom of lateral, and scarcely any vertical motion. The pectoral and ventral fins seem to serve chiefly for balancing the body, and guiding and staying its motion; the dorsal and anal fins, like the keel of a ship, for keeping it in its proper position. All the vertical fins are supported by bones which do not join those of the internal skeleton, but are thickest at the skin, from which they penetrate towards the vertebræ, being interposed between the spinous processes of the vertebral column. Several of the last caudal vertebræ are generally very short and combined, and the interposed spines which support the caudal fin converge towards them. The *rays* of fins are either pointed bones (spines)—sometimes prolonged beyond the membrane, and forming defensive weapons—or they are cartilaginous and jointed, in which case they often also branch near their summit. The caudal fin never has any other than these soft rays, and many F. have no other in any of their fins. A few F., belonging to different families, have the pectoral fins developed to an unusual degree, so as to make them capable of supporting short flights in the air (see FLYING FISH and FLYING GURNARD); and a few are capable of employing their fins as organs of locomotion in a very different way, creeping along the ground, or hopping among the weeds and stones of the shore.

The heart of F. consists only of one auricle and one ventricle, receiving venous blood only, and sending it to the gills, where, being oxygenated, it passes into the greater or systemic circulation by the dorsal vessel. See CIRCULATION. In most F., there is, close to the heart, a thick *bulb* or muscular swelling of the great artery which conveys the blood from the heart to the gills, and which assists in propelling the blood, being furnished with valves to prevent its regurgitation into the heart; and this bulb and its valves exhibit varieties admirably characteristic of different natural groups, much founded upon in the system of Müller and Owen. The blood of F. is red; its corpuscles are oval and of considerable size, but in general not very numerous. F. consume little oxygen in respiration, and are *cold-blooded* animals, having in general a temperature little elevated above that of the water in which they live; although there are some singular exceptions to this rule, as the tunny, sword-fish, etc., which, having a comparatively high temperature, have also redder blood with more numerous corpuscles. The oxygen appropriated by means of the gills in respiration is not obtained by decomposition of water, but from the air which is mixed in it, and hence the necessity of aërating an aquarium; hence also we perceive one of the benefits resulting from the agitation of the ocean and of lakes by winds. Some F. require a greater supply of air than they can easily obtain from the water, and frequently come to the surface to breathe. F. taken out of the water die from want of breath, in consequence of the drying up of the fine fringes of the gills; and those which are capable of subsisting longer out of water than others, have generally small gill openings, not so freely admit-

ting the air to dry the gills, whilst a few are provided with receptacles for water to keep them moist. See ANABASIDÆ.

The gills of F. are situated at the back part of the sides of the head, and consist of a multitude of very vascular membranous plants, which are generally in double fringe-like rows fixed by the base only, and simple, although in a few F. they are feathery, and in the greater number of *cartilaginous fishes* (q.v.), they are fixed both by their external and their internal edges, or consist of mere folds of membrane attached to the surface of the gill-cavities. In general, there are four gills on each side; the number is greater in some of the cartilaginous fishes. In osseous F., the gill-plates are attached to the external edge of the branchial arches, bony arches connected with the *hyoid bone* or bone of the tongue—which is unusually developed in F.—and with the base of the skull, the connection at both ends being effected by intervening small bones, and the whole forming a complicated system; whilst the cavity containing the gills, on each side of the head, is covered by a bony plate, the gill-lid, gill-cover, or *operculum*, with two subordinate pieces, called the *sub-operculum* and *inter-operculum*, articulated on the temporal bone, and playing on the *pre-operculum*, a bony plate placed before them in the head. It is by the motion of these bony plates that the water is expelled which is taken in by the mouth, and which, after passing amongst the gills, and supplying them with air, passes out by the gill-orifices at the back of the head. Besides these opercular plates or bones, a series of flattened rays, connecting them with the bone of the tongue, and called the *branchiostegal rays*, aid in forming the gill cavities. In the branchiostegal rays, distinctive characters of F. are often found.

The brain of F. differs very considerably from that of other vertebrate animals. See BRAIN. In general, they possess the nerves and organs of all the senses, although the senses of touch and taste are commonly supposed to be more dull than in many other animals; and a few F., living chiefly in mud, or in the waters of caverns, are destitute of eyes, and consequently of sight, although even they possess optic nerves, and seem sensitive to light. But in most of them, the eyes are large, and vision is evidently very acute; and some have cirri or barbules near the mouth, filaments proceeding from some of the fin-rays, etc., which are regarded as delicate organs of touch, adapted to the wants and habits of the particular species. The eyes are covered by the skin, modified in its character, and have no eyelids nor nictitating membrane. They are very variously placed in different kinds. There is no external ear.

The mouth is the only organ of prehension. It is very different in different kinds—sometimes very small, sometimes extremely large, sometimes forming a sucker by which the fish can both fix itself and pump up the fluids of the animal on which it preys. The snout is also abbreviated, prolonged, or otherwise modified in very various ways. The teeth are far more various in form, number, position, and structure, than in any other class of animals. They never have any roots, but are fixed to the bones which support them: they fall off, however, and are replaced. Some F. have no teeth; some have very small teeth; some have teeth in great number, but so fine as to resemble the hairs of a brush; some have short thick teeth; some have long sharp teeth, either straight or crooked; some have teeth so flat and closely set that they resemble a regular and beautiful pavement; and the teeth of F. are sometimes situated not only on the jaw-bones, but on the *vomer* or bone extending along the middle of the roof of the mouth, and indeed, also, on other parts of the palate to the very throat, and very commonly on the tongue. The food of F. is various: a few subsist on vegetable food of different kinds, but most of them on animal food, of which there is no kind that does not seem to be particularly agreeable to some of them, from the mere animalcule or the most minute crustacean to the flesh of the mammalia. In general, they are excessively voracious, and seem to spend most of their lives in seeking food. Many of them prey on other F., and many seem equally willing to devour other species or the younger and weaker of their own. Some of them swallow their food almost or absolutely alive; others subject it to processes of comminution, trituration, and mastication in the mouth. Salivary glands are not found in F., although they exist in some of the invertebrate animals. The digestive process seems to be performed very rapidly. The stomach and intestines vary very much in different kinds. The kidneys are in general extremely large, extending through the whole length of the abdomen.

The *air-bladder* is found in many F., but not in all; and is present or absent in different F. even of the same genus or family. See AIR-BLADDER. Its uses, and its connection with the habits of particular species, have as yet been but partially ascertained.

F. are oviparous (egg-producing); a few are ovoviviparous (eggs hatched within the body, and young produced alive). The chief reproductive organs are generally two elongated lobes of a fatty substance, *milt*, in the males, and of rudimentary eggs, *roe*, in the females. Impregnation usually takes place after the *roe* or *spawn* is deposited, the male accompanying the female to the place of spawning. In some cartilaginous F., it takes place before the deposition of the eggs; and male sharks and rays are furnished with organs called *claspers*, the use of which is well indicated by the name. The fecundity of F. is generally very great, and their eggs very small in proportion to the size which they ultimately attain, although this is not so much the case in the cartilaginous F. already mentioned. Some of the F. most valuable to man, as the salmon,

herring, and cod, are remarkable for their fecundity. Nine millions of eggs have, according to Leuwenhoek, been ascertained to exist in the roe of a single cod; and provision is thus made both for the preservation of the species amidst all the dangers to which the spawn and the young are exposed, and for the wants of man. The spawn of F. is deposited in very different situations, according to the different kinds—as by some on aquatic plants, by some on beds of sand and gravel; but many species leave the depths of the ocean in order to deposit it in shallower waters, and some, usually marine, ascend rivers for this purpose. Very few F. take any care of their eggs or young; but there are remarkable exceptions to this rule, and some of the gobies and sticklebacks are known to tend their young with great care. Sticklebacks also construct nests. See STICKLEBACK. It is not long since this curious fact was discovered, although these little F. have been so long familiarly known; and it is therefore not improbable that many other F. may have the same habit.

The growth of F. is very rapid when supplies of food are abundant, but becomes slow in less favorable circumstances, or is arrested for a long time, in a manner to which there seems to be nothing similar among other vertebrate animals.

The skin of F. is generally covered with scales (q.v.), which, however, are sometimes minute and imbedded in the skin, and sometimes altogether wanting. The scales are either horny or bony, and are generally imbricated, like the slates of a roof, their free ends backwards; but sometimes form bony plates, fixed by the whole of their lower surface. They usually exhibit beautiful symmetrical markings and inequalities of surface of various kinds, and in some are covered with a thick coat of enamel. The differences of character in the scales have been made the foundation of a classification of F. by Agassiz, by whom all F. are distributed into the four orders of *Cycloid*, *Ctenoid*, *Placoid*, and *Ganoid Fishes* (see these heads), having respectively cycloid, ctenoid, placoid, and ganoid scales; a classification which has been found particularly convenient with reference to fossil F., although other systems maintain their ground against it as preferable for recent species. It is not, however, wholly artificial, for a relation can be very generally traced between the character of the scales and the general structure and economy of a fish.

The scales of a row extending from the head to or towards the tail on each side of the body of osseous F. in a somewhat waved line, called the *lateral line*, are pierced for the transmission of a slimy matter, with which the whole body is lubricated.

The colors of F. depend upon a substance consisting of small polished laminæ, secreted by the skin.

As F. need no covering, like fur or feathers, to prevent the dissipation of their animal heat in the surrounding medium, their scales must be regarded chiefly as defensive armor. Some of them are also defended by large bony plates, which are either on the head alone or also on the body, and some by spines connected with the fins, gill-covers, etc. Few have any other offensive weapons than their teeth, but the spine attached to the tail of some rays is a remarkable exception, as is also the elongated snout or beak of the sword-fish, saw-fish, and a few others. But a much more remarkable kind of armor—probably both offensive and defensive—is possessed by a few F., in an electrical apparatus, by which they can give severe shocks. It is also an interesting fact, that the electrical apparatus is quite different in different F. possessing it, the gymnotus, or electric eel, the torpedo, and the electric silurus or malapterurus. See ELECTRICITY, ANIMAL.

Many F. are gregarious, swimming in shoals, which in some species consist of immense multitudes. Some also make periodical migrations; salmon, for example, ascending our rivers, and herrings and pilchards visiting our coasts, but the long migration formerly ascribed to these F. is now doubted or disbelieved. The occasional overland migrations of eels, and the more frequent overland migrations of some tropical F., cannot but be regarded with peculiar interest; and the instinct is very wonderful by which, when fleeing from a pool that is about to be dried up, they direct their course towards a place where water is more abundant. This faculty is, however, rare, although possessed by tropical F. both of the eastern and western hemispheres; but more generally the F. destined to inhabit tropical ponds which are liable to be dried up, are capable of living dormant, imbedded in the mud, till they are liberated again by the rains, when they reappear in their former multitudes.

Of the uses of F. to man, by far the most important is that of supplying him with food. F. form an article of food in almost all countries, and in some a principal part of the food of the inhabitants. Many F. are highly esteemed for the table, which are not procured in sufficient abundance to be a principal part of food in any country. Some F., on the contrary, are unpalatable; and some, mostly tropical, are poisonous, whilst others are poisonous only at particular seasons.—The skin of some cartilaginous F. yields shagreen (q.v.), and the air-bladder of some F. yields isinglass (q.v.). The minute laminæ which give brilliancy of color to some, and the similar substance found in the air-bladder of others, afford the materials of which artificial pearls are made.—Oil useful for lamps is obtained from a number of F., and the medicinal value of cod-liver oil is now well known.

The classification of F. most generally adopted is that of Cuvier, who divides them into OSSEOUS FISHES (having true bones), and cartilaginous fishes (q.v.), and

divides osseous fishes into acanthopterous F. (*acanthopterygii*, q.v.) and malacopterous F. (*malacopterygii*, q.v.). The system of Agassiz has already been noticed. That of Müller and Owen differs from both.

Fossil Fishes.—The medium in which F. live, and the hard and almost indestructible nature of some portions of their skeletons—as their teeth, spines, and scales—would lead us to anticipate their frequent occurrence in the sedimentary rocks; but inasmuch as the soft parts of the animal are liable to speedy decomposition, the remains of fish must often exist in a fragmentary and scattered condition. Thus, the teeth in the shark, the spine defense in the sting ray, and the scales in the bony pike, would survive the total destruction of the cartilaginous skeleton as well as the soft portions of these fish, and would alone remain to testify to their existence.

The earliest ichthyc remains are of this fragmentary character. They have been obtained from the "Ludlow rock," a member of the upper Silurian series, and consist of spines and portions of skin, that have been thickly covered with hard tubercles and prickles, like the shagreen of the shark's skin. The spines most nearly resemble the dorsal spine of the dogfish; they are small, flattened, and slightly curved. Along with other similar fragmentary remains, they have been placed under the somewhat indefinite generic title *onchus*.

The minute, compressed, conical, and glistening bodies, called *conodonts*, obtained in great numbers from the lower Silurian measures in Russia, and considered by their describer, Pander, to have been the teeth of F., belong certainly to very different animals. Their small size and peculiar forms, and the entire margin of the hollow base by which they were attached, show them to have been the denticles from the lingual ribbon of shell-less mollusks, which have left no other traces of their existence than these remarkable conodonts.

The Ludlow bone-bed contains the earliest noticed fish remains. No idea of the numerical importance of F. at this early period can be satisfactorily formed; yet these remains being confined to a single thin bed, and occurring rarely even in that, would seem to indicate that the Silurian seas were but thinly tenanted by these earliest sharks.

In the immediately succeeding Devonian rocks, their numbers largely increased. The ichthyodorulites, or fossil spines of this period, have been referred to fourteen different genera. Numerous species of true ganoids have been determined from their well-preserved enamel scales, which occur singly or in confused groups, and frequently also associated with the head, fins, and tail, so as to present a faithful "nature-print" of the fish upon the rock. See DIPTERUS, DIPLACANTHUS, etc. But the most remarkable and characteristic fossils of this period are the buckler-fishes, whose head and part of their body were covered with bony plates, giving them so singular and anomalous an appearance, that some of them were originally considered crustacean. They are almost confined to the old red sandstone series, a single species (found in permian strata) being the only cephalaspid that is known later. See CEPHALASPIS, CECCOSTEUS, PTERICHTHYS, etc.

Fish remains are of frequent occurrence in the coal-measures. Upwards of twenty species of plagiostomous F. have been determined from the spine defenses, some of which are very large and powerful. The frequency with which the peculiar teeth of the cestracionts are met, show that they must have been common in the carboniferous seas. Ganoids were also abundant. See PALÆONISCUS, HOLOPTYCHIUS, etc.

In the permian period, the forms are similar to what exist in the older strata. Up to the last permian deposit, the fish have all possessed heterocercal tails; but with the secondary rocks, the homocercal tail not only appears, but becomes the more frequent form.

Numerous species and many new forms appear in the trias and oolite. Sharks are remarkably abundant in the cretaceous strata; but the chalk is specially remarkable from containing the earliest discovered remains of the true bone-fishes—those covered with ctenoid and cycloid scales.

In the tertiary strata, the character and proportion of ichthyc remains exhibit a condition in the inhabitants of the water very similar to what at present prevails. The cartilaginous orders decrease, and are replaced by osseous F., such as the salmon, cod, turbot, and herring—F. which are of much greater value to man than those they superseded.

FISHES, ROYAL—i.e., those which at common law are the property of the crown—are the whale and the sturgeon, when either thrown on shore, or caught near the coast. The ground of the privilege is said to have been the superior value of these fishes. They were considered too precious for a subject, just as the swan (q.v.), which was a royal bird, was too good for any table but the king's. "Our ancestors," says Blackstone, "seem to have entertained a very high notion of the importance of this right, it being the prerogative of the kings of Denmark and the dukes of Normandy; and from one of these it was probably derived to our princes. It is expressly claimed and allowed in the statute *De Prærogativa Regis* (17 Edw. II. c. 11), and the most ancient treatises of law now extant make mention of it."—Stephen's *Com.* ii. p. 547. Strictly, it was the head only of the whale which belonged to the king, the tail being a perquisite of the queen-consort (*ib.* p. 457). In Scotland, whales thrown on shore above six horse-power

draught, belong to the queen or her donatary, the admiral. Smaller whales have been claimed both by the landlord and the tenant on whose ground they are cast, but they are usually given to the catcher. In Shetland, where the washing of whales on shore is an occurrence of sufficient frequency to have given rise to a local custom, they are equally divided between the proprietor of the soil and those concerned in catching them. See SALMON.

FISH-HOOKS. A considerable amount of skill is required for the successful manufacture of these simple articles. There are two kinds in the market, the English and the Limerick fish-hooks, the latter being long in the highest repute among anglers. Now, however, the largest number of fish-hooks are made at Redditch, in Worcestershire. Steel-wire is cut into the required lengths, and softened; then the ends of three of these are inserted into shallow holes of a sort of rest or standard, and thus supported, the barbs of all three together are cut up by the skillful pressure of a stout knife; they are then pointed, and turned by pressing them against a little ridge of sheet-brass let into a block of wood, and having the requisite curvature. The other end is next flattened out, by laying it on a small anvil, and striking a blow with a hammer. This is done to prevent the silk ligature from slipping over the end. The finer worm-hooks have the shanks filed, in order that the silk dressing may not enlarge the shank so much as to prevent the slipping of the worm over it. They are then hardened, tempered, and blued. The Limerick hooks are made by cutting the steel, which is made from the best malleable iron, into lengths for two hooks. The ends are then forged out to the shape of barb and point, and the barb is undercut *with a file* from the solid forged end, instead of being cut and turned up with a knife. On this the reputation of the Limerick hooks depended. They are shaped to the required curve by grasping them in circular pliers, and bending the wire with a turn of the wrist.

FISH-HAWK, the name in America of the *pandion haliaëtus*, a bird of prey belonging to the sub-family of eagles, inhabiting the temperate regions in the vicinity of rivers, lakes, and the sea. The American fish-hawk is 2 ft. long, with an expanse of wing of 5 feet. Its powerful and long-protracted flight, and its dexterity in seizing prey, are well known. Soaring slowly at a moderate height above the water, it singles out a fish, then suddenly closing its wings, darts down, sometimes going entirely under the water. If successful it carries the fish to a tree and devours it at leisure. It is said that the hawk sometimes pounces upon a fish too heavy for it, and is kept under water until drowned. Occasionally the hawk is robbed of its prey by the stronger and more daring bald eagle.

FISHING. The capture of fishes for food has been carried on in a variety of ways from the most remote antiquity, and is probably at least as ancient as the hunting or trapping of any kind of wild animal. The supply of food yielded to man by the waters seems always to have borne a very considerable proportion to that yielded by the land. Of all modes of capturing fish, the most simple and primitive is that of taking them with the hand, which is still an amusement of boys, who thus catch trout in small streams by groping below the stones where they hide. This is called in the e. of Scotland *gumping*, in the w. *ginneling* or *guddling*. Even sea-fish are sometimes taken by the hand, approaching the shore in such dense shoals that the water seems almost to be filled with them. This is particularly the case on the north-western coast of North America, a region which appears to abound in fish more than any other part of the world; and there, besides the occasional use of the mere hand, the Indian often catches fish by means of a hand-net or a basket, paddling his canoe into the midst of the shoal, and, as it were, baling the fish out of the water. The use both of the net, in various forms, and of the hook and line, as well as also of the fishing-rod, are very ancient. Allusion is made in several places of the Old Testament to the use both of nets and hooks in the capture of fish. Some of the most important fisheries, as the herring-fishery, are carried on almost exclusively by the net. For different fisheries, however, nets of very different kinds are used. See FISHERIES and NETS; also HERRING, SALMON, and other articles on the most important kinds of fish. The capture of some very valuable kinds of fish—as cod, haddock, and others of the same family—takes place chiefly by means of the hook and line, and either by what is called the *long-line*, to which many hooks are attached, and which is extended horizontally over a bank frequented by the fish, its place being marked by floats, and drawn after the lapse of at least several hours; or by the *hand-line*, which, being let down over the side of a boat with a *sinker* proportioned to the strength of the current, is watched by a fisherman holding it in his hand, and hauled up immediately on a fish being felt to bite. The baits are, of course, various, according to the opportunity of procuring them and the kinds of fish. The use of the fishing-rod along with the hook and line is not so general for the capture of sea-fish as of fresh-water fish. See ANGLING. A rude fishing-rod, however, is often used for the capture of some sea-fish. The pollack (q.v.) or lythe, the mackerel, and some other fish of the British seas, are often caught by rod-fishing from boats under sail. The young of the coal-fish (q.v.) are caught in great numbers by the fishing-rod from rocks on the British coasts; and this, which is chiefly an amusement for boys in most parts of Britain, supplies no inconsiderable part of their food to the inhabitants of Orkney and Shetland. The shooting of fishes with arrows is practiced by some of the

South American Indians; some very large kinds of fish—as the arapaima (q.v.)—are occasionally harpooned; and many large fish, both of the sea and of the fresh water, are killed by means of spears—a mode of fish-capture common enough in some parts of Scotland, and much employed by salmon-poachers, the spear—three-pronged—being known as a *leister*. Torches are also used by night in many parts of the world, both in sea and river fishing, to attract fishes by the light, which in this way has an almost certain effect. The poacher on a Scottish salmon-river conjoins the use of the torch with that of the leister, and this is popularly known as "burning the water." It is now wholly illegal, as is the use of the leister under any circumstances. The flying-fish is similarly attracted by torches on the coasts of the South Sea islands, but a small net is used instead of a fish-spear. The inhabitants of the South Sea islands take advantage of the habit of some fishes, of leaping out of the water when alarmed, to catch them by means of rafts in the shallow lagoons, encircling them so that they finally leap upon the rafts. The Indians of north-western America sometimes adopt a similar method of capturing the viviparous fish (q.v.) of their coasts. Other very peculiar modes of catching fish which are in use among them are described in the articles CANDLE-FISH and SALMON OF NORTH AMERICA. They also take the Vancouver island herring (see HERRING, VANCOUVER ISLAND) by constructing long dams of lattice-work on flats left dry by the retiring tide, in which the fish are caught which have come in with the tide. This method of taking herring, however, has long been known on the British coasts; and *cruives*, which are lattice-work constructions of a smaller size, have been used with great success in many places. Cruives are also very effective in the capture of salmon, a suitable place of the river being chosen for them, and they being so contrived that the fish readily get in, but do not readily get out. A very peculiar mode of taking fresh-water fishes is practiced in Ceylon, by means of a funnel-shaped basket, open at both ends, which is suddenly plunged down, the wider end downwards, till it sticks in the mud, when, if a fish is felt to beat against the sides, it is taken out with the hand.

The capture of fresh-water fish by means of vegetable poisons of various kinds, is practiced equally in the East Indies, in Africa, and in the warm parts of America. The poisons used do not render the fish poisonous. The poisoning of trouts and other river-fish with lime is too frequent in some parts of Britain, and is one of the worst kinds of poaching, all the fry, as well as the fish fit for the table, being destroyed, and the mischief often extending far farther down the stream than the perpetrators of it proceed in pursuit of their spoil.

Cormorants are trained by the Chinese for the capture of fish. Otters have also not unfrequently been trained and employed for the same purpose. For a full account of sea-fishing, and the apparatus employed, the reader is referred to *The Sea Fisherman*, by J. C. Wilcocks.

FISHING-FROG. See ANGLER.

FISHING-TACKLE. See ANGLING.

FISHKILL, a t. and village in Dutchess co., N. Y., on the e. bank of the Hudson, opposite Newburg, 58 m. n. of New York, on the Hudson River railroad; pop. of township, '75, 13,471. The village has several manufactories, churches, schools, etc., and has steamboat connection with New York and Albany, and by ferry with the city of Newburg. It presents picturesque views of the river and the hills.

FISH-LOUSE, or SEA-LOUSE, names commonly given to the entomostracous crustaceans of the order *siphonostoma*. All the creatures of this order are of small size, and parasitic on fishes, aquatic batrachians, etc., on the juices of which they live, although they have also the power of swimming freely in the water, some of their legs being adapted to this purpose, and, indeed, they can swim with extreme rapidity, making use of this power to gain that place where they may obtain food at the expense of other creatures. They do not begin life as parasites, the females depositing their numerous eggs on stones, plants, etc. They are animals of singular form and appearance. The genera *argulus* and *caligus* are now regarded as the types of two families. In the former, there is a curious sucking disk on each side of the beak, or proboscis, although there are also jointed members terminated by prehensile hooks. In the latter, the hooks of the anterior pairs of feet are the principal organs of adhesion to the slippery bodies of the fishes from which food is to be drawn; and the abdomen of the female is furnished with two remarkably long tubes, the functions of which are not perfectly ascertained. The bodies of all of them are transparent, or nearly so. Some of the *caligidæ* are common on many of the British sea-fishes; *argulus foliaceus* on fresh-water fishes, and even on tadpoles. Sickly fishes often become the victims of multitudes of these creatures.

The name fish-louse is sometimes given also to the *lernæidæ*, but they are very different.

FISH-PONDS. See PISCICULTURE.

FISK, or FISC, a term often to be found in Scottish law-books. It is derived from the Latin *fiscus*, literally, a wicker-basket, which came ultimately to signify the privy purse of the emperor, as distinguished from the public treasury, which was called *ærarium*. In Scotland, it signifies, generally, the crown's revenues, to which the

movable estate of a person denounced rebel, was formerly forfeited. It still gives his name to a very important officer, the procurator fiscal (q.v.), or public prosecutor in the first instance, by whom all crimes are prosecuted before sheriffs and other inferior judges, and whose duty it is to report to crown counsel—i.e., to the lord advocate, or his deputies—all cases which, from their aggravated character, require to be tried by a higher court. See PUBLIC PROSECUTOR.

FISK, JAMES, Jr., 1835–72; b. Vt.; in early life a small trader, or peddler; afterwards in a large dry-goods house in Boston, as clerk, and then as partner. In 1863, he bought the Stonington line of steamers, and started the New York and Boston line to Bristol. In 1867, he became a director in the Erie railroad, and soon rose to be almost sole manager. In 1868, he bought Pike's opera-house in New York, also an interest in opera bouffe, and was prominent in the militia as colonel of a regiment. His stock speculations were daring, sometimes enormous, and usually fortunate. His social relations, however, led him into difficulty, and he was assassinated by Edward S. Stokes, Jan. 6, 1872.

FISK, WILBUR, D.D., 1792–1838; b. Vt.; graduated at Brown university; studied law, but entered the Methodist ministry; was delegate to the general conference and presiding elder of the Vermont district. He was especially earnest in advancing education, and, with others, founded an academy at Wilbraham, Mass., of which he was the head. In 1828, he was chosen bishop of the Canada conference; the next year president of La Grange (Ala.) college, and professor in the university of Alabama. He was also the first president of Wesleyan university at Middletown, Conn. While absent in Europe in 1835–36, he was chosen bishop of the Methodist Episcopal church, but he declined the position. Among his works are: *Sermons and Lectures on Universalism; Reply to Pierpont on the Atonement; The Calvinistic Controversy;* and *Travels in Europe.*

FISKE, FIDELIA, 1816–64; b. Mass., a niece of the Rev. Pliny Fiske. In 1843, she went to Persia as a missionary of the American board among the Nestorians, and was the first principal of the seminary for women at Oroomiah. She returned 15 years later in consequence of ill-health, and died the following year, having laid the foundation of a great educational work.

FISKE, JOHN, 1744–97; b. Mass., a seaman, and commander of the *Tyrannicide*, the first war-vessel sent out by Massachusetts in the revolution. He made a number of important captures. In 1777, he was given command of the *Massachusetts*, a larger and better ship. After the war he went into commerce.

FISKE, NATHAN WELBY, 1798–1847; b. Mass.; graduated at Dartmouth, and in theology at Andover; was professor of Greek, Latin, and intellectual and moral philosophy, in Amherst college, 1824–47. He translated Eschenburg's *Classical Manual*. Some of his sermons have been published. He was the father of Helen Hunt, known in literature as "H. H."

FISKE, SAMUEL, b. Mass., 1828–64; graduated at Amherst; was tutor in Andover theological seminary; tutor in Amherst college; traveled in Europe a year; and in 1857 was settled over the Congregational church in Madison, Conn. He served in the union army as a volunteer during the war of the rebellion, and was killed at the head of his company in the battle of the Wilderness. In journalism he was known as "Mr. Dunn Browne" in letters to the *Springfield Republican*. He published also *Experiences in the Army*. He had, in rare combination, profound earnestness of spirit and firmness in principle, with great vivacity and wit, and unfailing gentleness.

FISSIROS'TRES (Lat. split-beaked), a tribe of birds, one of the tribes into which the great order *insessores* is divided. It is characterized by peculiar width of gape, and the bill is depressed or horizontally flattened, short, and often furnished with strong bristles at the angles; the birds of this tribe being insectivorous, and generally subsisting by catching insects on the wing, to which this structure of bill is beautifully adapted. The powers of flight are generally great, but the legs are short and weak. Swallows and goat-suckers are familiar examples of this order.

FISSUREL'LIDÆ, a family of gasteropodous mollusks, of the order *scutibranchiata*. The shell much resembles that of the limpet family (*patellidæ*), but has either a hole at the apex, or a slit at the front margin. The hole at the apex characterizes the genus *fissurella* (keyhole limpets), and the slit appears in the genus *emarginula*. These openings of the shell are subservient both to the passage of the water requisite for respiration, and the discharge of the excrements. The F. resemble limpets in their habits, and are found either on the sea-shore or at no very great depth. They are widely distributed over the world. Several species are British.

FISTULA, in former times, was applied, in its etymological meaning of a *pipe*, to such abscesses (q.v.) as had contracted to narrow, hard, open passages in the soft texture of the body (see TISSUE), lined by a kind of false membrane, giving rise to a thin discharge. At the present time, however, the term F. is generally limited to the opening of such a passage when in close contact with a mucous membrane. Thus it is common to speak of salivary, urinary F., etc.; and the most common and troublesome kind of all is the F. in ano, in connection with the lower bowel, or rectum

(q.v.). The treatment of F. should only be intrusted to experienced surgeons; but there are always quacks in abundance willing to undertake it, and hold out flattering hopes of an early cure without proper surgical procedure.

For the cure of salivary or urinary F., all that is generally necessary is to restore the patency of the ducts, which is done by passing instruments along them. Should a F., however, be situated where it is surrounded by muscular fibers, as at the orifice of the lower bowel, it is necessary to divide these muscular fibers, so as to leave the part at rest while nature repairs it. As the sinus, which is the continuation inwards of the F., is lined with imperfectly organized lymph, it is generally necessary to stimulate the part by the introduction of lint, either alone or saturated with some irritant, such as the sulphate of zinc, which, when mixed in the proportion of 1 to 3 grains to each ounce of water, and colored with lavender, makes the famous red lotion of the shops.

At times, however, fistulæ require more elaborate treatment, and are extremely difficult to close, especially those which result from loss of tissue between two adjacent mucous canals; fortunately, however, modern surgery is able to remedy these also. It is necessary to make the edges of the orifice once more raw, and to bring them in contact, but formerly the wound used rarely to unite, as the stitches produced such an amount of irritation. Now, however, by the use of silver or iron wire, according to the taste of the surgeon, the parts can be kept together long enough to insure union; and thus, by the ingenuity of American surgeons, especially Marion Sims of New York, and others in this country, certain diseases of women, arising from protracted labors, and formerly rendering the unfortunate subjects of them miserable and unfitted for any of the duties of life, may be now remedied by a skillfully performed but almost painless proceeding.

FISTULA, in farriery, the name given to an abscess usually situated on the withers of a horse, and discharging pus. Sometimes it appears on the head, when it is called poll-evil.

FISTULA'RIDÆ, AULOSTOM'IDÆ, or FLUTEMOUTHS, a family of acanthopterous fishes, remarkable for the conformation of the head; the skull being elongated into a tube, at the extremity of which are the mouth and jaws. The species are all marine; they are widely distributed; only one, the snipe-fish, sea-snipe, or trumpet-fish (*centriscus scolopax*), is found, and that very rarely, in the British seas. These fishes are not to be confounded with the pipe-fishes, which have a similar elongation of snout, but are otherwis every different.

FISTULI'NA, a genus of fungi allied to *boletus* (q.v.); the under surface (*hymenium*) at first covered with minute warts, which ultimately form tubes. *F. hepatica* is common in Britain and throughout Europe on old oak, walnut, and chestnut trees; it occurs also on ash and beech. It is semicircular, of very regular outline, with a lateral stem, or none; its color red; the substance fibrous and fleshy, much resembling beet-root. When old and beginning to decay, it looks like a mass of liver. It sometimes attains a great size. Dr. Badham describes a specimen nearly 5 ft. round, and weighing 8 pounds. Mr. Berkeley mentions one which grew on an ash pollard, and weighed nearly 30 pounds. This fungus is much esteemed in some parts of Europe as an esculent; it is wholesome and nutritious; and the abundance in which it may often be procured, makes it the more worthy of regard; whilst there is almost no possibility of confounding it with any dangerous fungus. Its taste resembles that of the common mushroom, but is rather more acid. "When grilled, it is scarcely to be distinguished from broiled meat." It furnishes itself with abundance of sauce.

FITCH, EBENEZER, D.D., 1756–1833; b. Conn; graduated at Yale; was tutor there; principal of the Williamstown (Mass.) school, and when it became a college, its first president. He was for 12 years pastor of the First church, Bloomfield, N. Y.

FITCH, ELEAZAR THOMPSON, D.D., 1791–1871; b. Conn.; graduated at Yale, where he was professor of divinity and preacher to the college. He was the author of several articles in theological magazines. His sermons have been published, and are known as models of convincing argument and practical instruction.

FITCH, JAMES, 1622–1702; b. England; came to New England in 1638; pastor of the First church (Congregational) in Saybrook, Conn., 1646–60, and the first settled minister in Norwich. He could preach to the Mohegan Indians in their own language. He published *First Principles of the Doctrines of Christ*.

FITCH, JOHN, 1743–98; b. Windsor, Conn. The son of a farmer, and receiving only a common-school education, he became noted for his discoveries and inventions in connection with steam navigation. When quite a lad, he made a few voyages before the mast, but became tired of that business, and devoted himself at various times to different mechanical trades. The war of the revolution breaking out, he became a sutler on the American side, and collected by his profits quite a large sum of money, which he invested in land in Virginia. In 1780, F. became deputy-surveyor for Kentucky, and a year later, while traveling, was captured by the Indians, but soon released. He next devoted himself to the production of a map of the north-western country; and the idea of employing steam in the navigation of the western rivers, on which he sailed, having occurred to him, he sought by the sale of this map to obtain the means for his

experiments. Unsuccessful in this, he next turned his attention to the state legislatures, but failed to obtain an appropriation; he at last succeeded in forming a company, and with the assistance thus obtained, constructed a steam-packet, which was launched on the Delaware in 1787, and reached a speed of 8 miles an hour. F. now obtained exclusive rights of steam navigation in New Jersey, Pennsylvania, and Delaware, and in 1790 built a boat to convey passengers on the Delaware river for hire. The scheme proved unfortunate, and the company which sustained F. was dissolved. In 1793, he went to France with the hope of introducing his invention, but failed, and returned to America disheartened and impoverished. In the mean time his Virginia lands had fallen a prey to "squatters," and heart-broken by his failures and disappointments, he committed suicide. Six years prior to his death, F. placed in charge of the Philadelphia library a sealed package, with directions that the seals should not be opened until 1823. When opened, it was found to be indorsed (inside), "To my children, and to future generations," and to contain a full record of the writer's inventions, adventures, and disappointments.

FITCH, Ralph, one of the earliest English travelers who visited India. He was a merchant in London in the latter half of the 16th c., and who undertook to improve his trading facilities by personally visiting the countries with which he was chiefly concerned. He accordingly sailed with four other merchants in Jan., 1583, in the *Tygre*, for Tripoli, in Syria, whence the party journeyed to Bagdad, and by the Tigris river to Bussorah; thence down the Persian gulf, landing at Goa, and penetrating the interior of India. F. afterwards visited Cochin and Ceylon alone, and returned to England in 1591. The account of his journey was included in Pinkerton's collection of travels, under the title: *The Voyage of Mr. Ralph Fitch, Merchant of London, to Ormus and so to Goa, in the East Indies; to Camboia, Ganges, Bengala; to Pegu, to Jamahay in the Kingdom of Siam, and back to Pegu; and from thence to Malacca, Zeilan, Cochin, and all the Coast of the East Indies.*

FITCHBURG, a thriving city, one of the capitals of Worcester co., Mass., on a branch of the Nashua river, 40 m. w.n.w. of Boston. It includes the villages of Crockerville, Rockville, South Fitchburg, Traskville, and West Fitchburg. It is the terminus of four railways—to Boston, Worcester, Brattleboro, and Keene and Bellows Falls. The principal buildings are the masonic hall, the city hall, the jail, the court-house, and the high-school. It has woolen, cotton, and paper mills, machine-shops, chair-manufactories, iron-foundries, and brass-foundries. Fitchburg was originally included in Lunenburg. It was incorporated as a separate town in 1764, and became a city in 1872. The population in 1860 was 7,805, and in 1870 it amounted to 11,260.

FITCHET. See Polecat.

FITCHY, or Fitché. Crosses are said, in heraldry, to be fitchy when the lower branch ends in a sharp point. Crosses are supposed to have been so sharpened to enable the primitive Christians to stick them into the ground for devotional purposes.

FITS, a name popularly applied to convulsions (q.v.), or, indeed, to any sudden seizure of disease implying loss of consciousness, or any considerable change in the condition of the mind.

FITZ is an old Norman word signifying "son," evidently from the Lat. *filius* (Fr. *fils*). Like the Scotch *Mac*, the Irish *O'*, and the oriental *Ben*, it is prefixed to proper names to signify descent, as in the Norman names Fitzwilliam, Fitzwalter, Fitzgerald. A later application of it has been to denote the natural sons of royalty, as in Fitzroy, Fitzjames, and Fitzclarence. The Russian termination *witch* is a disguised form of the same word.

FITZGERALD, Augustus Frederick, Duke of Leinster, 1791–1874; succeeded his father in 1804, and entered the house of lords; became lord lieutenant of county Clare, and member of the queen's privy council. He was for many years the only duke in Ireland, and was for a long time grand master of freemasons. The Fitzgeralds are among the most ancient families of Ireland.

FITZGERALD, Edward, Lord, 1763–98; one of the leaders of the united Irishmen, a younger son of the first duke of Leinster; born near Dublin. At 10 years of age, he lost his father, and, his mother marrying again, the family soon after settled in France. Lord Edward was carefully educated by his step-father, Mr. Ogilvie, chiefly with a view to the profession of a soldier. Returning to England in 1779, he entered the English army, and in 1781 he sailed with his regiment for America, where he soon obtained the appointment of aide-de-camp on the staff of lord Rawdon. He served in the war with no little reputation for personal courage, readiness of resource, and humane feeling. He was severely wounded at the battle of Eutaw Springs. After the surrender at Yorktown, he joined the staff of gen. O'Hara at St. Lucia, and the same year returned to Ireland. He was returned as member for Athy to the Irish parliament; but the high hopes which he had cherished for serving his country faded away at the spectacle of political corruption and suppression of all genuine representation by the penal law against Roman Catholics. In 1787, he set out for a visit to the s. of Europe, went afterwards to America, and in 1790 returned to England, and resumed his seat in the Irish parliament. The French revolution had broken

out, and he was one of those ardent spirits that welcomed with enthusiasm the promise of its first days. In 1792, he was attracted to Paris, and made the acquaintance of the most famous leaders of the revolution. Having publicly renounced his title of nobility and avowed his sympathy with the republicans, he was dismissed, with other officers, from the English army. It was during his visit to Paris that he was introduced to the lady then known as "Pamela," the daughter of Madame de Genlis, by the duke of Orleans. In 1792, they were married at Tournay, and returned to Ireland in 1793. After a period of singular happiness spent in a country home, his sympathies with the struggles of his countrymen led him out to the troubled arena of politics. He joined in 1796 the united Irishmen, and was sent to France to negotiate a treaty with the directory for a French invasion of Ireland, and to urge on with the utmost zeal the preparation for an Irish insurrection. But the scheme was betrayed, several of the leaders were arrested, and Fitzgerald concealed himself in a house in Dublin, still continuing to direct the movement. A price was set on his head, the place of his retreat was discovered, and, after a severe struggle, he was captured by police officers and committed to prison. There he died of the wounds which he had received; a bill of attainder was passed against him, and his estates were confiscated; but the attainder was at a later time reversed. His widow married Mr. Pitcairn, American consul at Hamburg; but the union was an unhappy one, and ended in a separation by mutual consent. Lady Fitzgerald henceforward lived in retirement at Montauban till 1830, when she removed to Paris—Louis Philippe, the associate of her childhood, having become king of the French. He, however, refused to see her, and she died in poverty in 1831. [Compiled from *Ency. Brit.*, 9th ed.]

FITZGERALD, Thomas, Lord, d. 1536, was vice-deputy of Ireland for his father, Gerald, ninth earl of Kildare, in the reign of Henry VIII. He appears to have accompanied his father to London early in 1534, on occasion of the third summons of the earl to answer grave charges of maladministration as lord deputy. But after the earl's committal to the Tower, he was sent back to Ireland, to take the place of vice-deputy in his father's absence, with secret instructions to raise a rebellion against the English government. He was at this time hardly of age, and his amiable manners and accomplishments had procured for him the appellation of "silken Thomas." He was, however, of a high spirit and fiery temper, and fiercely resented the English rule. As soon as he arrived in Ireland, he cleared the way by formally surrendering his office and the sword of state, and then openly proclaimed a rebellion. He obtained possession of Dublin city before the end of July, and besieged the castle, into which the English governor had withdrawn. Archbishop Allen, the primate who had been appointed by Henry VIII. to keep watch over Kildare and to report his proceedings, sought safety in flight, and sailed for England. But the ship was run aground, and the archbishop was seized by the young lord Thomas and massacred in his presence with his English chaplains and attendants. This murder was reported by a special messenger from Fitzgerald to the pope and the emperor, the former being asked for absolution if necessary, and the latter for assistance. Sentence of excommunication was pronounced on Fitzgerald for this murder of the archbishop. In Aug., he was forced to relinquish the siege of Dublin castle and hasten to defend or recover his own domains, which the earl of Ormond had invaded. He tried in vain to seduce Ormond from his allegiance, but obtained a truce, of which he took treacherous advantage to attack him. He then again besieged Dublin, which had closed its gates against him. In Oct., in consequence of Ormond's renewed invasion of Kildare, he was compelled to raise the siege. Three days later the English army landed at Dublin, and was enthusiastically welcomed. Fitzgerald withdrew into the country; but taking advantage of the inactivity of Skeffington, the new deputy, he again approached Dublin, and burnt two villages near the city. The old earl had been attainted, and he died in the tower soon after hearing of his son's rebellion and excommunication. The death-blow to the rebellion was at length given by Skeffington, who, in Mar., 1535, stormed the castle of Maynooth, the chief stronghold of the "Geraldines." Lord Thomas, who had now succeeded his father, but did not assume the title, retreated into Thomond, intending to sail for Spain and plead with the emperor. This scheme was relinquished, and after leading a wandering life for some months, with a price set upon his head, he surrendered without definite conditions to lord Leonard Grey, and was at once conducted by him to England. He was committed to the Tower with his five uncles; and the six Geraldines were hung at Tyburn as traitors, Feb. 3, 1536. An act of attainder was passed against the earl of Kildare, lord Thomas, and others, in 1537; but the family estates were restored by Edward VI., and the attainder was repealed by queen Elizabeth. [Compiled from *Ency. Brit.*, 9th ed.]

FITZHERBERT, Maria, 1759–1837; wife of George IV. of England, daughter of Waller Smythe; widow, first of Edward Weld, and secondly of Thomas Fitzherbert. The prince of Wales (subsequently George IV.) saw her first in 1785, and married her in Dec. of that year. This union was by the law of England illegal, as it is forbidden a prince of the blood-royal to marry a subject. After the quarrel with his lawful wife (queen Caroline), George returned to Mrs. Fitzherbert, but because of his excesses, she was unable to live with him. She retired on a pension from the government.

FITZROY, Robert, 1805–65; b. England; went into the navy in 1819, and became vice-admiral in 1863. In 1828, he was in company with Darwin, the naturalist, in an expedition to South America. Subsequently he was a member of parliament, and in 1848 governor of New Zealand. In 1854, he became superintendent of the meteorological department of the board of trade, and in 1862 established a system of storm-warnings. With capt. King he wrote *Narrative of the Surveying Voyages of H.M.S. Adventurer and Beagle.* He published a *Barometer Manual, and Weather-Book.*

FITZSIMMONS, Thomas, 1741-1811; b. Ireland; was a merchant in Philadelphia, and commanded a company in the revolution. He was in the state assembly and the continental congress, and from 1789 to 1795 in the federal congress. He was prominent as a leader in financial and trade matters in Philadelphia.

FIU'ME (in the Illyrian language, *Reka* or *Rika;* Latin, *Fanum St. Viti ad flumen*), an important seaport of Austria, is situated at the efflux of the Fiumara into the gulf of Quarnero, in the Adriatic, 40 m. s.e. of Trieste, across the Istrian peninsula, in lat. 45° 20′ n., and long. 14° 26′ east. F. has quite the character of a German town, is adorned with many handsome buildings, and consists of an old and new town, which together contain (1869) 18,314 inhabitants. It has manufactures of tobacco, paper, ropes, Whitehead torpedoes, and a flourishing trade in ship-building. F. has a fine quay, with a light-house, and its commerce is of late increasing. It has been a free port since 1722; and in 1849 was severed from Hungary with the territory to which it belongs, but since 1870 is again under the Hungarian administration.

FIVE FORKS, Battle of, April 1, 1865, in Dinwiddie co., Va., a little s.w. of Petersburg; one of the closing conflicts of the expiring rebellion. Lee, the confederate commander, was at Petersburg, and had taken possession of the "five forks" in order to protect the Southside railroad and thereby his connections with Richmond. Sheridan with a union force made an unsuccessful effort (Mar. 30, 31) to capture the position. On April 1, he renewed the attempt with about 12,500 men. After heavy fighting from daylight until nearly dark, the confederates were completely defeated, losing more than 5,000 in prisoners alone. The whole union loss was less than 1000. A few days afterwards Lee's surrender ended the war of the rebellion.

FIVE HUNDRED, Council of, established by the French constitution, Aug. 22, 1795, and unceremoniously dissolved by Napoleon, Nov. 10, 1799. It was one of two legislative bodies, the other being the "council of ancients" with 250 members.

FIVE-MILE ACT, passed by the English parliament in 1665. It forbade non-conformist ministers, who refused to take the non-resistance oath, to come within 5 m. of any corporation where they had preached since the act of oblivion (unless they were traveling), under a penalty of £40. The act was not repealed till 1689.

FIVES, a popular game in England, and one especially enjoyed by school-boys, and in certain barracks where there is a "court," by soldiers. The game existed at a very early period—14th c.—both in France and England, being termed "palm-play" in the former, and "hand-tennis" in the latter; its present name is derived from its being played usually by five on each side. The method of playing the game is very simple: a good roomy court is requisite, bounded by a high wall at one end, and against this wall a ball is propelled by striking it with the open hand. The players arrange themselves either 5 against 5, as is usually the case, or in fewer numbers, and begin the game by one member striking the ball against the wall, and causing it to rebound anywhere beyond the floor-score, which is about two yards from the wall; one of the opposite party then strikes the ball as it rebounds, and if it does not touch the wall higher than 3 ft. from the ground, his stroke goes for nothing, and the opposite party score one. The ball may be struck either from a direct rebound before it reaches the ground, or after it has "dapped" or hopped from the ground once. Fifteen is usually game. When the players are skillful, the ball is kept going by the alternate strikers for many minutes at a time, and the game is thus rendered exciting both for players and onlookers.

FIXED AIR was the name given to carbonic acid (q.v.) by Dr. Black, who was the first to observe that the solid substance, carbonate of magnesia ($MgO.CO_2$), could, when heated, evolve carbonic acid (CO_2), proving that the latter was a *fixed air* whilst in union with the magnesia.

FIXED BODIES is a term applied in chemistry to those substances which remain fixed, and are not volatilized at moderately high temperatures.

FIXED OILS are those oils which, on the application of heat, do not volatilize without decomposition. See Oils.

FIXED STARS. See Stars.

FIXING, in photography. When a picture has been obtained through the agency of light, by the exposure of a sensitive surface suitably prepared, and the subsequent development of the latent image, there remains in the deepest shadows of the picture a portion of the sensitive material, unacted upon by light. The removal of this unaltered sensitive material by an appropriate solvent is termed fixing, though the term *clearing* would perhaps be preferable, fixing being more strictly accurate in the case of the

daguerreotype process (q.v.), where the picture is literally *fixed* to the silver-plate by the deposition of a film of metallic gold, of extreme tenuity, from a boiling hot solution of sol d'or (q.v.).

For particulars of failures arising from imperfect fixation or clearing, see **PHOTOGRAPHY.**

FIXTURES, in the law of England, are those personal chattels (q.v.) which are let into the soil, or otherwise actually affixed to the freehold; a definition which is sufficiently accurate to afford a principle for the solution of the questions which arise between landlord and tenant as to the right of the former to retain, or of the latter to remove—but a principle, the application of which is attended with many practical difficulties. If the chattels be entirely clear of the soil, they are not F. at all, and may be carried off at pleasure like any other species of personal property. The general rule as to what constitutes a fixture legally immovable is, that it must be either let into the earth, or cemented or otherwise united to some erection previously attached to the ground, so that it would be waste to remove it afterwards (Woodfall, pp. 466, 467). But it must be remarked, that a tenant may in all cases construct any erection he may make in such a manner as that it shall not become a fixture. Thus, if he even erect buildings—as barns, granaries, sheds, and mills—upon blocks, rollers, pattens, pillars, or plates, resting on brick-work, they may be removed, although they have sunk into the ground by their own weight (*ib.* 467). To this rule various exceptions have been made in favor of what have been called *trade-fixtures*, or F. put up for the purpose of carrying on a trade; and the statute mentioned below has greatly modified the law as to those erected for agricultural purposes. It is difficult to state the limits of the exception with reference to trade-fixtures with any approach to accuracy. The following is perhaps as near an approach as the varying circumstances of each individual case will admit of: "Whenever the following circumstances occur, it may be confidently pronounced that there the tenant may safely remove the article. Thus, things which the tenant has fixed to the freehold for the purposes of trade or manufacture, may be taken away by him whenever the removal is not contrary to any prevailing practice; where the articles can be removed without causing material injury to the estate, and where of themselves they were of a perfect chattel nature before they were put up, or at least have in substance that character independently of their union with the soil—or, in other words, where they may be removed without being entirely demolished, or losing their essential character or value" (*ib.* p. 468); see also the case of Hellawell *v.* Eastwood, 6 Excheq. Rep. 812. Nurserymen have been allowed to remove trees and shrubs which they have planted expressly for purposes of sale, but not to plow up strawberry-beds, out of the ordinary course of management of the nursery-ground. Neither can they remove hot-houses, green-houses, forcing-pits, or other erections of that description; and in no case can private persons sell or remove fruit-trees, though planted by themselves (Amos and Ferand on *Fixtures*, 343, 2d ed.). The provision of the common law of England with reference to agricultural F. has been modified by 14 and 15 Vict. c. 25, s. 3, which provides, that if any tenant of a farm or land shall, with the consent in writing of the landlord for the time being, at his own cost, erect any farm-buildings, either detached or otherwise, or put up any other building, engine, or machinery, either for agricultural purposes or for the purposes of trade and agriculture (which shall not have been put up in pursuance of some obligation in that behalf), then all such buildings, engines, and machinery shall be the property of the tenant, and shall be removable by him, notwithstanding the same may consist of separate buildings, or that the same, or any part thereof, may be built in or permanently fixed to the soil, so as the tenant making such removal do not in anywise injure the land or buildings belonging to the landlord, or otherwise do put the same in like plight and condition as the same were in before the erection of anything so removed, provided that no tenant shall be entitled to remove any such matter or thing without giving to the landlord or his agent one month's previous notice in writing of his intention so to do; and thereupon it shall be lawful for the landlord, or his agent, on his authority, to elect to purchase the matters and things proposed to be removed; and the right to remove the same shall thereby cease, and the same shall belong to the landlord; and the value thereof shall be ascertained by two referees, one to be chosen by each party, or by an umpire to be named by such referees, and shall be paid or allowed in account by the landlord who shall have so elected to purchase." This act is confined to England; but in questions of F., as Mr. Hunter observes, the common law of England having been deemed practically authoritative in Scotland, the clause affords valuable matter for consideration, as showing what has been held advisable in England (*Landlord and Tenant*, p. 290, 3d ed.). In Scotland, it has been customary, in agricultural leases more particularly, to determine the respective rights of landlord and tenant by positive stipulation, and, for this reason, fewer points have been decided by the courts than in England.

As regards urban tenements, the rule seems to be, that the tenant may remove whatever he has fixed up for ornament or domestic use—e.g., hangings, wainscot, stoves, etc., but not such erections as have become part of the tenement, and constitute permanent improvements. Thus, he cannot remove a conservatory fixed to and communicating with rooms in a dwelling-house by windows and doors.

FLAC'CUS, C. VALERIUS, a Roman poet, who flourished in the 1st c., and is supposed to have died 88 A.D. Absolutely nothing is known regarding his life. He is the author of an epic poem on the Argonautic expedition, which in its extant form is incomplete. Some modern critics, Wagner among others, praise it extravagantly, and place the author next to Virgil; but the more general opinion of sound scholars is, that the work is rather a specimen of learned mediocrity than of genuine inspiration. The *editio princeps* of the *Argonautica* appeared in 1472. Of modern editions, may be mentioned those of Wagner (Gött. 1805) and Lemaire (Paris, 1824). An English metrical translation was published by one Nicholas Whyte as early as 1565. Similar translations exist in French, Italian, and German.

FLACCUS, VERRIUS, a grammarian and teacher in Rome in the time of Augustus; a freedman, who was honored by having the emperor's grandsons among his pupils. He was the author of a number of works, from which extracts were collected by Lindemann in his *Corpus Grammat. Latinorum.*

FLACIUS, MATTHIAS, *1520–75; a German theologian, one of the converts of Luther and Melanchthon. He was the head of a party of extreme Lutherans at Magdeburg; was professor of the university founded at Jena in 1558, and afterwards preached in several German cities. He was one of the authors of the *Centuries of Magdeburg*, and sole author of a number of vigorous polemical works.

FLACOURTIA'CEÆ, a natural order of exogenous plants, allied to passion-flowers, consisting of shrubs and small trees, almost exclusively confined to the warmest parts of the globe. Many of the species, particularly of the genus *flacourtia*, produce pleasant, sweet, or subacid fruits. *Flacourtia inermis* is much esteemed and cultivated in the Moluccas. Arnotto (q.v.) is produced by a tree of this order.

FLAG, a popular name for many endogenous plants with sword-shaped leaves, mostly growing in moist situations. It is sometimes particularty appropriated to the species of *iris* (q v.), or flower-de-luce; but is given also very indiscriminately to other plants of similar foliage, as the *acorus calamus* (see ACORUS), which is called sweet flag.

FLAG (common to the Teutonic languages, and derived from a root signifying to fly), a cloth of light material, capable of being extended by the wind, and designed to make known some fact or want to spectators. In the army, a F. is the ensign carried as its distinguishing mark by each regiment; and also a small banner, with which the ground to be occupied is marked out. In the navy, the F. is of more importance, often constituting the only means vessels have of communicating with each other, or with the shore. For this purpose, devices of conspicuous colors (usually black, white, red, yellow, or blue) are hoisted at the mast-head or at the gaff. The flags having three forms, a very few patterns in each shape give sufficient combinations of three or four flags to express any letter or word in the language. The F. is also a sign of the rank of the principal person on board a vessel, as the "royal standard," containing the arms of the United Kingdom, which is only hoisted when a member of the royal family is on board; the anchor of hope, on a red ground, denoting the admiralty; the pennant, which specifies the ship of war; and the ensign, which denotes the nation.

A white F. is accepted throughout the whole world as a token of peace; a red F., as defiance; and a black F. denotes a pirate; a F. of plain yellow usually signifies that the vessel bearing it is in quarantine. See also UNION JACK.

FLAG (*ante*). The U. S. standard is briefly noticed under American flags, but a more extended account of that and other flags is required. Naturally the regular English flag was used by the colonies in their early days, and that was commonly the cross of St. George. The Puritan spirit was shown when Endicott, the governor of Massachusetts, cut the cross from the flag because it was a Romanist emblem. The colonial flags varied in color, it being sufficient if ground and cross differed. Now and then a pine-tree was figured in the upper left-hand quarter of the cross, and one flag had only the tree for a symbol. When sir Edmund Andros was governor he established a special flag for New England, a white field with a St. George cross, and in the center "J. R.," *Jacobus Rex* (James, King), surmounted by a crown. The revolution brought in all manner of devices for flags and banners, the larger portion bearing mottoes more or less defiant of the foreign government. Soon after the fight at Lexington the volunteers from Connecticut put on their flag the arms of the colony, with the legend "*Qui transtulit sustinet*" (He who brought us over will sustain us). The colonial flag of New Amsterdam (substantially the present arms of New York city) was carried by armed vessels sailing out of New York—a beaver being the principal figure, indicative of both the industry of the Dutch people and the wealth of the fur trade. The day after the battle of Bunker Hill, Putnam displayed a flag with a red ground, having on one side the Connecticut motto, and on the other the words "An Appeal to Heaven." The earliest vessels sailing under Washington's authority displayed the pine-tree flag. An early flag in the southern states was designed by col. Moultrie and displayed at Charleston in Sept., 1775. It was blue with a white crescent in the upper corner next the staff; afterwards the word "Liberty" was added. At Cambridge, Mass., Jan. 2, 1776, Washington displayed the original of the present United States flag, consisting of 13 stripes of red and white, with a St. Andrew cross in place of the stars. The rattlesnake flag was used to some extent in two forms:

in one the snake was intact, and under the figure the words "Don't tread on me;" in the other form the snake was in 13 pieces, and the legend was "Join or Die;" and in some cases the snake had 13 rattles. Ten days after the declaration of independence, congress directed the style of the flag of the United States, as heretofore described, with its later modifications. By the war department the stars in the union are usually so placed as to form one large star. In the navy the stars are in straight lines, perpendicular and horizontal. The 38 states now in the union make five horizontal lines of eight stars, with two vacancies at the right-hand end of the middle rows. The union jack is a blue ground with all the stars but no stripes. During the war of the rebellion the seceding states had a number of distinct flags. Early in 1861, however, their congress decided upon what was popularly called the "Stars and Bars," which was composed of three broad horizontal bars, the two outer ones red and the middle one white, with a blue "union" containing nine stars in a circle. Some variations were afterwards made, but they need not be noticed. There are many flags which designate special or personal position or authority. Among such are royal standards, flag-officers' flags, etc. An admiral's flag is usually the flag of the country which such admiral serves, with the exception of the "union." The flag of admirals, vice-admirals, and rear-admirals of the United States is rectangular, and consists of thirteen alternate red and white stripes. The admiral hoists this at the main; the vice-admiral at the fore; the rear-admiral at the mizzen. Should there be two rear-admirals present, the junior hoists at the mizzen a flag similar to the one described, with the addition of two stars in the left-hand corner. The commodore's flag differs from that of the admiral's in form alone, being swallow-tail instead of rectangular. Should the president go afloat, the American flag is carried in the bow of his barge or hoisted at the main of the vessel on board of which he may be. In foreign countries the royal standard is displayed at ceremonies in honor of the sovereign or at which the sovereign may be present. A flag placed midway on the staff, or "half-mast," is a sign of mourning. A flag reversed or upside down indicates distress. Salutes are made by dipping the flag by hauling it down a short distance and immediately raising it several times in succession.

FLAG-CAPTAIN, in the navy, is the captain of the admiral's ship in any squadron, and is ordinarily his nominee.

FLAGELLANTS, the name given to certain bodies of fanatical enthusiasts, who, at various intervals from the 13th to the 16th c., made their appearance in the different countries of Europe, proclaiming the wrath of God against the corruption of the times, inviting sinners to atone for sin by self-inflicted scourgings or flagellations, and themselves publicly enforcing this exhortation by voluntary scourging of themselves, and by other forms of self-castigation. In large and disorderly bands—frequently headed by priests, and by fanatics in the costume of priests and monks, bearing banners and crucifixes aloft, their breast and shoulders bare, and their face concealed by a hood or mask, each armed with a heavy knotted scourge, loaded with lead or iron—they marched from town to town, chanting hymns full of denunciations of vengeance and of woe. In the most public place of each town which they entered they threw themselves upon the earth, with their arms extended in the form of a cross, and there inflicted upon themselves the discipline of scourging, frequently to blood, and even to mutilation. Each member enrolled himself for 33 days, in honor of the 33 years of the life of our Lord on earth; and all for the time professed entire poverty, subsisting only on alms or voluntary offerings. These fanatical movements, resembling, in some respects, at least, the religious revivals of our own time, recurred at frequent intervals. The most remarkable, however, are three in number. The first originated at Perugia in 1260, at a time when society in Italy was greatly disorganized by the long continued struggles of the Guelph and Ghibelline factions. The very disorders of the time prepared the way for this religious reaction. Numbers crowded to follow the new cry, until at last the body became so formidable as to draw upon itself the suspicions of Manfred, the son of Frederic II., by whom it was vigorously suppressed. Later offshoots of the party made their appearance in Bavaria, Austria, Moravia, Bohemia, Poland, and France, when to their extravagant practices they added still greater extravagances of doctrine. In virtue of a pretended revelation, they asserted that the blood shed in self-flagellation had a share with the blood of our Lord in atoning for sin; they mutually confessed and absolved each other, and declared their voluntary penances to be a substitute for all the sacraments of the church, and for all the ministrations of the clergy. The Jews were to them an object of special abhorrence; and this unfortunate race, exposed at all times to every caprice of the popular will, suffered dreadfully from the fury of the F. in many of the towns of Germany and the Netherlands. In the second outbreak of flagellantism, about 1349, the outrages against public decency were much more flagrant than at its first appearance. Men and women indiscriminately now appeared in public half naked, and ostentatiously underwent these self-inflicted scourgings. The immediate occasion of this new outburst of fanaticism was the terror which pervaded society during the dreadful plague know as the Black Death, which Hecker, in his *Epidemics of the Middle Ages,* describes with terrible fidelity. The same extravagances were again repeated in upper Germany, the provinces of the Rhine, the Netherlands, Switzerland, Sweden, and even England. Although rigorously excluded from France, these fanatics

effected an entrance into Avignon, then the residence of the popes, when they were condemned by a bull of Clement VI. The mania gradually subsided, nor do we again find any permanent trace of it till the beginning of the next century. In the year 1414, a new troop of F., locally called *Flegler*, made their appearance in Thuringia and Lower Saxony, renewing and even exaggerating the wildest extravagances of their predecessors. These new fanatics appear to have rejected all the received religious usages, and indeed all external worship, placing their entire reliance on faith and "flagellation." Their leader was called Conrad Schmidt. They rejected not only the doctrines of the church upon the sacraments, but also purgatory and prayers for the dead. Schmidt pretended a divine mission, and proclaimed that the blood of flagellation was the true wedding-garment of the gospel; that it was more precious than the blood of the martyrs, and a sure passport to eternal life. The violence of these fanatics drew upon them the severest punishments of the inquisition. Many of them were capitally condemned, and Schmidt himself was burned at Sangerhausen in 1414. Their doctrines, comprised in fifty articles, were condemned in the council of Constance.

These strange extravagances are reprobated by the Roman Catholic church in common with all other Christian communities; but Roman Catholics (relying on 1 Cor. ix. 27, Coloss. iii. 5) hold the lawfulness, and even the meritorious character, of voluntary self-chastisement, if undertaken with due dispositions, practiced without ostentation or fanaticism, and animated by a lively faith and a firm hope in the merits of Christ. This is the self-castigation known under the name of "the discipline"—a form of mortification not unfrequent in the monastic state, and even practiced by lay persons, and these sometimes of the highest rank, both in ancient and in modern times. Compare Förstemann's *Die Christlichen Geisslergesellschaften*, Wadding's *Annales Minorum Fratrum*, Raynaldi's *Continuation of Baronius*, Mosheim's *Church History* (Soames' ed.), Gieseler's *Kirchengeschichte*, and Milman's *Latin Christianity*.

FLAG'EOLET, a wind instrument with a mouth-piece like the common whistle. It is made of boxwood or ivory, in several pieces, and has holes for the fingers, like the flute. According to Burney, the F. was invented by Sieur Juvigny in 1580.

FLAGEOLET-TONES is the name given to the harmonic notes of the violin, violoncello, and other stringed instruments, which notes are produced by the finger lightly touching the string on the exact part which generates the harmony, and not by pressing the string down to the finger-board. The string vibrates on both sides of the finger, the long side dividing itself into parts of the same length as the short side. See HARMONICS. The inventor of the manner of playing flageolet-tones is said to have been Domenico Ferrari. The best work on the subject is by Collinet.

FLAGG, GEORGE WHITING, b. Conn., 1816; a pupil of his uncle, Washington Allston, the painter. He studied in Europe three years and resided six years in London, working for the most part on portraits. Returning to the United States, he resumed work in New Haven. Among his pictures are "Landing of the Pilgrims," "Washington Receiving his Mother's Blessing," "Landing of the Atlantic Cable," "The Scarlet Letter," "Haidee," etc.

FLAGG, JARED BRADLEY, D.D., b. Conn., 1820; brother of George Whiting. He studied and practiced painting for several years, but turned his attention to theology, and in 1854 became a deacon in the Episcopal church, and was afterwards rector in several places, among which was Grace church, Brooklyn, N. Y. Of late years he has again given attention to painting.

FLAG-LIEUTENANT is an officer who, in the navy, performs such duties for an admiral as would devolve upon an aide-de-camp in the army. He communicates the admiral's orders to the various ships, either personally or by signal.

FLAG-OFFICER, in the British navy, is an admiral, vice-admiral, or rear-admiral. He is so called from his right to carry, at the mast-head of the ship in which he sails, a flag denoting his rank. For an admiral, the flag is borne at the main; for a vice-admiral, at the fore; and for a rear-admiral, at the mizzen; the flag being, in either case, a red cross on a white ground. For the former division by squadrons, see ADMIRAL.

FLAG OF THE PROPHET (Sanjak-Sherif) is the sacred banner of the Mohammedans. It was originally of a white color, and was composed of the turban of the Koreish, captured by Mohammed. A black flag was, however, soon substituted in its place, consisting of the curtain that hung before the door of Ayeshah, one of the prophet's wives. This flag, regarded by the Mohammedans as their most sacred relic, first came into the possession of the followers of Omar at Damascus; it afterwards fell into the hands of the Abbasi; then passed into those of the caliphs of Bagdad and Kahira; and, at a later period, was brought into Europe by Amurath III It was covered with forty-two wrappings of silk, deposited in a costly casket, and preserved in a chapel in the interior of the seraglio, where it is guarded by several emirs, with constant prayers. The banner unfolded at the commencement of a war, and likewise carefully preserved, is not the same, although it is believed by the people to be so.

FLAG-SHIP, the ship in a fleet which bears the admiral's flag, and therefore forms a sort of center to which all other vessels must look for orders. It is usually the largest vessel in the fleet.

FLAGSTONE, a rock which splits into tabular masses, or flags of various size and thickness, in the original plains of stratification. Flagstones are generally sandstones, combined with more or less argillaceous or calcareous matter; some, however, are indurated clays, and others thin-bedded limestones. They are used for paving, cisterns, etc. The most famous are those of Festiniog (North Wales), remarkable for their large size, even grain, and great beauty; those of Yorkshire, also of large size, and of great hardness and toughness; and those of Caithness, which are extremely tough and durable. The Caithness flags belong to the old red sandstone; the Yorkshire are taken from the millstone grit division of the coal measures.

FLAHAULT DE LA BILLARDERIE, AUGUSTE CHARLES JOSEPH, Comte de, a French soldier and diplomatist, was b. at Paris on 20th April, 1785. He was destined for the army by his father, a general officer; and when a mere lad, he crossed the Alps with Napoleon as a volunteer in a cavalry regiment. He was rapidly promoted to the rank of aide-de-camp of Napoleon. He distinguished himself in the peninsular war and the Russian campaign; and in 1813, received the title of count, and the rank of general of division in the new army. On the return of Napoleon from Elba, he was one of those who recommended him to abdicate in favor of his son. He became an exile after Waterloo; and while in England, married a Scotch heiress, lady Keith, the proprietor of Tullialian, in Clackmannanshire, and a British peeress in her own right. His name was afterwards removed from the list of exiles. After the revolution of 1830, F. returned to France, and was restored to his rank in the army. He entered the household of the king, and was appointed ambassador to Vienna, a post he held from 1842 to 1848. After the establishment of the second empire, F. was called to the senate, and in 1860, sent as French ambassador to London, a post for which his acquaintance with this country, and connection through his wife with the higher classes in England, well fitted him, and which he retained until 1862. In 1864, he was named grand chancellor of the legion of honor. His daughter married the fourth marquis of Lansdowne. He died in 1870.

FLAMBARD, RANULPH, or RALPH, d. 1128. He was a Norman of humble origin, who came to England in the train of William the Conqueror. He took holy orders, was chaplain to the bishop of London, prebendary of St. Paul's, and chaplain to William II., who raised him to the highest places in the church because in his unscrupulous greediness he flattered the vices of his master. To obtain money for the king, he devised oppressive measures by which he rightly earned the hatred of the people. His extortions were so flagrant, that an attempt to kill him was made in 1099, but the conspirators quarreled, and he was spared. Then the king made him bishop of Durham, for which honor he had to pay £1000. As soon as William died, the clamors of the people sent Flambard to the Tower, the first prisoner in that afterwards celebrated fortress. In 1101, he escaped and fled to Normandy, where he instigated Robert to an invasion of England, and accompanied the duke on the venture. He was restored as bishop of Durham, and thenceforward appears to have led a more reputable life, devoting himself to forwarding important architectural works.

FLAMBOROUGH HEAD (Saxon, *Fleamburgh*), a promontory of the Yorkshire coast, and forming the northern boundary of Bridlington bay. It terminates a range of white perpendicular chalk cliffs, 6 m. long, 300 to 450 ft. high. Its rugged sides contain many caverns, and in the sea near are picturesque chalk rocks, which swarm with sea-birds. The chalk contains fossil sponges, crinoids, etc. On the head is a lighthouse, 214 ft. high, seen 19 m. off. Across the peninsula, ending in the head, runs a ditch with two lines of defense and breast-works, called Dane's dike, but really ancient British work.

FLAMBOY'ANT, the latest style of Gothic architecture which prevailed in France. It prevailed there during the 15th and part of the 16th centuries, and corresponds to the perpendicular (q.v.) in England. The name is derived from the flame-like forms of the tracery of the windows, panels, etc. The characteristics of this style are minute and elaborate ornament, combined with general bareness of surface. The crockets, for instance, are generally cut into a great number of small leaves, while they are placed far apart; the moldings are divided into large empty hollows, and small thin fillets and beads; the finials have crockets minutely carved, set upon bare pyramidal terminals; the arch-moldings are divided into a great number of small parts, and want the boldness and decision of the earlier styles. These moldings are frequently abutted on the pillars, or continued down them without any caps; and when there are caps, they are small and without effect. When moldings join, they are frequently run through one another, so as to appear to interlace. The effect is intricate rather than beautiful, suggestive, like the rest of the style, of ingenuity in stone-cutting rather than art. The doorways and windows are sometimes large and fine; but while these are highly enriched, the general surface of the building is left too plain. There are many large buildings in France executed in this style, but it is usually portions only which are fine, not the general effect. Some of the spires of this period are also very beautiful. The north spire of Chartres cathedral, for example, is considered one of the finest in France.

FLAME is a particular form of combustion (q.v.) or burning. Ordinary combustion consists in the oxygen of the atmosphere combining with some combustible substance so

rapidly as to give out light and heat. When the combustible is either originally a gas, or becomes so by the heat, the combustion takes the form of flame. F., then, is the burning of a gas. In most cases, the gas of F. is a compound of hydrogen and carbon, with minute particles of solid carbon suspended in it, and is formed from the fuel (coal, tallow, etc.) being decomposed by the heat. The heat and light of F. vary with the gas; hydrogen produces great heat, but little light. The lighting power of a gas depends upon the proportion of carbon it contains, the particles of which become glowing hot before being consumed.

The F. of a lamp or candle, or simple gas-jet, consists of a hollow cone, in the center of which there is no combustion. The central space appears dark only by contrast with the luminous cone which surrounds it. It consists, in reality, of transparent invisible compounds of carbon and hydrogen, which are constantly rising in vapor from the wick. If a glass tube, open at both ends, be held obliquely in the F. of a candle, with its lower extremity in the dark central space above the wick, it will conduct away a portion of the combustible vapor, which may be kindled like a gas-jet at its upper end. This dark portion of the F. may be called *the area of no combustion*.

The luminous cone which envelops the dark space is *the area of partial combustion*. The oxygen of the atmosphere penetrates to this depth, but not in sufficient quantity to oxidize or burn both the carbon and the hydrogen; it therefore unites with the hydrogen, for which it has the stronger attraction, and leaves the carbon free. The outer cone is named *the area of complete combustion*, because there the carbon meets with sufficient oxygen to burn it entirely. The light is produced in the area of partial combustion, where the carbon is set free from the hydrogen in the form of solid particles, and is heated to whiteness by the combustion of the hydrogen. The combustion of the carbon in the outer cone, by which it is converted into carbonic acid gas, produces heat, but so little light as to be barely traceable.

That carbon exists in a solid state in the white part of a F., is readily shown by holding a piece of white earthen-ware into it, which becomes coated with carbon in the form of soot. No soot is deposited in the dark or no-combustion area of the flame, because there the carbon is in chemical combination with hydrogen, forming a gas. The carbon becomes solid only when the hydrogen deserts it, as it were, to unite with oxygen.

The highly illuminating power of compounds of hydrogen and carbon is thus traced to the fact, that *their hydrogen and carbon do not burn simultaneously, but successively, and in such a way that the one heats the other white hot.* It is quite possible to make them burn simultaneously; but when they do, the light evolved is very feeble. This takes place in the "Bunsen burner," in which air is allowed to mix with the gas before combustion.

FLAMENS were priests in ancient Rome devoted each to some special deity. There were 15 in all. The chief of these (*Flamines Majores*) were the F. of Jupiter, of Mars, and of Quirinus, who were always patricians; the remaining 12 (*Flamines Minores*) were chosen from the plebeians. The F. were elected at first by the *Comitia Curiata*, but afterwards by the *Comitia Tributa*, and were installed into their office by the supreme dignitary of the Roman pagan religion, the *Pontifex Maximus*. The flamen of Jupiter was a privileged person; he was not required to take an oath, was attended by a lictor, his house was an asylum, and he had a seat in the senate. But all this was attended by numerous superstitious restrictions: he might not have a knot on any part of his attire, nor touch flour, or leaven, or leavened bread; he might not touch or name a dog, or mount a horse, or be a night out of the city, etc. His wife, called Flaminica, was subjected to similar restrictions, and when she died, the flamen was obliged to resign. The majority of Roman writers attribute the institution of F. to Numa.

FLAMINGO, *Phœnicopterus*, a genus of birds which until recently was placed by all naturalists among the *grallatores* (waders), but is now generally ranked among the *palmipedes*, and even referred to the family of *anatidæ*. The bill is large, deeper than broad, and suddenly curved downwards near the middle, so that, as the bird wades and seeks its food, either in the water or in the mud, it makes use of the bill in a reversed position, the upper mandible being lowest. The edges of both mandibles are furnished with small and very fine transverse laminæ, which serve, like those in the bills of the ordinary *anatidæ*, to prevent the escape of the small crustaceans, mollusks, worms, small fishes, seeds, etc., which are the F.'s food, and to separate them from the mud with which they may be mingled. The upper surface of the tongue is also furnished on both sides and at the base with numerous small flexible horny spines, directed backwards. Unlike the ordinary *anatidæ*, flamingoes have great part of the tibia, as well as the tarsus, naked, in this resembling all the waders. They are birds of powerful wing, and fly either in strings or in wedge-shaped flocks like geese, a single bird leading the way for the flock. They seldom make use of their webbed feet for swimming, to which the length of their legs is not well adapted, the use of the membrane being rather to support them on soft muddy bottoms. When feeding, they keep their feet in almost constant motion, as if to stir the mud. Hundreds may sometimes be seen feeding together in the shallow waters or salt marshes of tropical coasts, chiefly of Asia and Africa, or on the banks of rivers or inland lakes, and by their large size and rich colors making a

brilliant spectacle. They make their nests in marshes, scraping together a heap of mud, on the top of which is the nest; and it is said that the long legs of the female F. often hang down into the water during the incubation, not being easily disposed of otherwise.—There are several species of F., but very similar to each other, both in appearance and habits. One species only visits the s. of Europe, the common F. (*P. ruber*), a bird measuring fully 4 ft. from the tip of the bill to that of the tail, and 6 ft. from the tip of the bill to the claws; the male, when in full plumage, is of a rose-red color, with deep purple wings; the female, and the young for several years, are less brilliant, the young at first being whitish, and the red first appearing on the wings.—The AMERICAN F. (*P. Americanus* or *Chilensis*) is of a more orange tint, and is abundant on many parts both of the eastern and western coasts of America.

FLAMIN'IAN WAY (*Via Flaminia*), the great northern road of ancient Italy, leading from Rome to Ariminum (*Rimini*) on the Adriatic. It was constructed by C. Flaminius during his censorship (220 B.C.), and was designed to secure a free communication with the recently conquered Gaulish territory. The F. W. was one of the most celebrated and most frequented roads of Italy both during the period of the republic and of the empire. Its importance may be estimated from the fact, that when Augustus (27 B.C.) appointed persons of consular dignity road-surveyors for the other highways of his dominions, he reserved the care of the F. W. for himself, and renewed it throughout its whole length. Its general direction was northerly. Leaving Rome, it kept for the most part at no great distance from the Tiber till it reached Narnia (*Narni*), where it struck off in a north-easterly direction, passing Interamna (*Terni*) and Spoletium (*Spoleto*), and reaching the foot of the Apennines, at Forum Flaminii. Crossing the central ridge of the Apennines at Ad Ensem (La Schieggia?), it again proceeded in a northerly direction, pursuing much the same line of route as the modern road from Foligno to Fano, and reached the Adriatic at Fanum Fortunæ (Fano), whence it wound along the coast to Ariminum (Rimini), where it ended, or rather where the name ceased; for the Via Æmilia (see EMILIAN PROVINCES) was just a continuation of it. The whole length of the road from Rome to Ariminum was (according to the Jerusalem Itinerary) 222 m., and according to the Antonine, 210 miles. Remains of it still exist at various places, and assist the antiquary in tracing its direction.

FLAMININUS, TITUS QUINCTIUS, 228–174 B.C.; a Roman general and statesman, the liberator of Greece. He came into public life as a tribune under Marcellus. In 199, he was made quæstor, and the next year rose to consul, in which capacity he was sent to Macedonia, where he conducted the war with Philip. Previous commanders had been dilatory and incompetent, but the new consul manifested the greatest energy and activity. In an engagement soon afterwards, he routed the Macedonians and became master of Epirus, making friends by his moderation. Step by step he won the several Grecian states, and in the spring of 197 B.C., he took the field with nearly the whole of Greece at his back. After a cavalry skirmish near Pheræ, the main armies met at Cynoscephalæ, a low range of hills so called from a fanciful resemblance to dogs' heads. It was the first time that the Macedonian phalanx and the Roman legion had met in open fight, and the day decided which nation was to be master of Greece, and perhaps of the world. It was a victory of intelligence over brute force, and, where numbers and courage were equally matched, the superior strategy and presence of mind of the Roman general turned the scale. The left wing of the Roman army was retiring in hopeless confusion before the deep and serried ranks of the Macedonian right, led by Philip in person, when Flamininus, leaving them to their fate, boldly charged the left wing under Nicanor, which was forming on the heights. The phalanx was like a steam-hammer, irresistible if it hit its object, but moving only in one direction, and easily thrown out of gear. Before the left wing had time to form, Flamininus was upon them, and a massacre rather than a fight ensued. This defeat was turned into a general rout by a nameless tribune who collected 20 companies and charged in rear the victorious Macedonian phalanx, which in its pursuit had left the Roman right far behind; 8,000 Macedonians were killed, and 5,000 taken prisoners, while the Romans lost only 700. Macedonia was now at the mercy of Rome, and Flamininus might have dictated what terms he liked, but he showed his usual moderation and far-sightedness in disregarding the root-and-branch politics of his Ætolian allies, whose heads were turned by the part which they had taken in the victory, and contenting himself with his previous demands. Philip lost all his foreign possessions, but retained his Macedonian kingdom almost entire. Such a valuable bulwark against the outer world of Thracians and Celts was not lightly to be removed. Ten commissioners arrived from Rome to regulate the final terms of peace, and at the Isthmian games which were celebrated at Corinth in the spring of 196, a herald proclaimed to the assembled crowds that "the Roman people, and Titus Quinctius, their general, having conquered king Philip and the Macedonians, declare all the Greek states which had been subject to the king henceforward free and independent." A shout of joy arose so loud that it was heard by the sailors in the harbor, and in Plutarch's time the legend told how birds flying over the course had dropped down stunned by the noise. The games were forgotten, and all crowded around the proconsul eager to kiss the hands of the liberator of Greece, who was almost smothered with chaplets and garlands. This day was indeed

the climax of Flamininus's career, of which even the stately triumph that two years later he obtained at Rome must have seemed but a pale reflection. His last act before returning home is characteristic of the man. Of the Achæans, who vied with one another in showering upon him honors and rewards, he asked but one personal favor—the redemption of the Italian captives who had been sold as slaves in Greece during the Hannibalic war. These to the number of 1200 were presented to him on the eve of his departure, and formed the chief ornament of his triumph. In 192, on the rupture between the Romans and Antiochus, Flamininus returned to Greece, this time as the civil representative of Rome. His personal influence and skillful diplomacy secured the wavering Achæan states, cemented the alliance with Philip, and contributed mainly to the Roman victory of Thermopylæ. In 189, he was made censor. In this office his fair name was sullied by an unseemly quarrel with Cato. Brotherly affection tempted him to shield from just punishment a dissolute and brutal ruffian. In 183, he undertook an embassy to Prusias, to induce the king of Bithynia to deliver up Hannibal. Hannibal forestalled his fate by taking poison, and his dying words justly stigmatized this pitiful victory over a defenseless and destitute old man. The only excuse for F. in this action is that it was prompted not by wanton cruelty or love of revenge—motives which were wholly alien to his character—but by restless ambition and inordinate love of glory. The history of his later years is a blank, and we learn from his biographer Plutarch only that his end was peaceful and happy. (Chiefly from *Encyc. Brit.*, 9th ed.)

FLAMINIUS, Caius, d. 217 B.C.; a Roman tribune, prætor, and censor, and twice consul; the constructor of the circus and the great highway bearing his name. The latter was the first road across the Apennines, and connected the Tuscan and Adriatic seas. When a second time elected consul, without staying to go through the usual solemnities of installation at the capitol, or to celebrate the feriæ Latinæ, Flaminius hastened to Ariminum and thence to Arretium, there to be ready for an aggressive campaign against Hannibal as soon as the roads should be open. Meanwhile, Hannibal, uneasy in his winter quarters, had accomplished, with comparative ease, the passage of the Apennines, and forced his way southward across the flooded plains of the lower Arno. The consul, fearing lest the enemy should find Rome unprotected, impetuously set out in pursuit. Free to select his own ground, Hannibal chose to make his stand between Borghetto and Passignano, in the narrow defile formed by the hills of Cortona, which is closed at its entrance by the Trasimene lake. With the main body of his infantry he barred the further outlet at the hill of Torre, while the light troops and the cavalry were posted on the sides of the pass. It was early morning (June 23, according to the uncorrected calendar, but in reality on some day in April) when Flaminius reached the spot, and a thick haze covering hill and lake, altogether concealed the position and even the existence of the enemy, until the Roman army found itself completely and hopelessly surrounded in the fatal defile. In the three hours' carnage that followed, 15,000 Romans perished, and Flaminius was among the slain. From the materials which Livy and Polybius furnish, it is manifest that Flaminius was a man of ability, energy, and probity, who with the bravery of a true soldier combined many of the best qualities of a popular democratic leader. While eminent, however, as the head of a political party, and successful in carrying some pieces of useful legislation, he has little or no claim to rank among the greater statesmen of the republic. As a general, moreover, he was headstrong and self-sufficient, and he seems to have owed such victories as he achieved to personal boldness favored by good fortune rather than to any superiority of strategical skill. (Compiled from *Ency. Brit.*, 9th ed.)

FLAMMARION, Camille, b. 1842; a French astronomer. He received his education in the ecclesiastical seminary of Langres and at Paris, was a student in the imperial observatory from 1858 till 1862, when he became editor of the *Cosmos*, and was appointed scientific editor of the *Siècle* in 1865. At this period, by a series of lectures on astronomy, he obtained considerable reputation, which was subsequently increased by his giving in his adhesion to spiritualism. In 1868, he made several balloon ascents, in order to study the condition of the atmosphere at great altitudes. M. Flammarion is the author of *La Pluralité des Mondes Habités; Les Mondes Imaginaires et les Mondes Réels; Les Merveilles Célestes; Dieu dans la Nature; Histoire du Ciel; Contemplations Scientifiques; Voyages Aériens; L'Atmosphère; Histoire d'un Planète;* and *Les Terres du Ciel.*

FLAMSTEED, John, the first astronomer-royal of England, for whose use the royal observatory at Greenwich (called Flamsteed house) was built, was b. near Derby, 19th Aug., 1646, and early devoted himself to mathematical and astronomical pursuits. While yet a youth, he mastered the theory of the calculation of eclipses; and his calculations of some remarkable eclipses of the moon were the means of introducing him to the notice of the eminent scientific men of his time, among others to sir Jonas Moore, then surveyor-general of the ordnance, through whom, and in connection with whose department, he was appointed astronomer to the king in 1675. The year following, the observatory at Greenwich was built, and F. began that series of observations that constitute the commencement of modern practical astronomy. He formed the first trustworthy catalogue of the fixed stars, and furnished those lunar observations on which Newton depended for the verification of his lunar theory. Extracts from the papers of F., found in the observatory by Mr. Francis Baily, and published by authority of the

admiralty, in 1835, brought to light a very sharp quarrel that had taken place between F. and Newton and Halley with regard to the publication of the results of F.'s labors. The *Historia Cœlestis Britannica*, his great work, in 3 vols., giving an account of the methods and results of astronomical observation up to his time, was begun to be printed before his death in 1719, but was not published till 1725. It may be mentioned that F., while following his scientific pursuits, qualified himself for holy orders, and in 1684 was presented to the living of Burslow, in Surrey, which he held till his death.

FLANCHES, or FLANQUES, in heraldry, are composed of arched lines drawn from the upper angles of the escutcheon to the base points. The arches of the flanches almost meet in the center of the shield. The flanches are an ordinary little used in Scotch heraldry.

FLANCONNADE, a thrust in fencing (q.v.).

FLANDERS was formerly the name of an extensive and almost independent territory ruled by "counts," and embracing, besides the present Belgian provinces of the same name, the southern portion of the province of Zealand in Holland, and some of the departments in the n.e. of France. Cæsar found this district inhabited by the Morini, the Menapii, and the Nervii, and having conquered these tribes, he annexed the country. Under the rule of the Franks, the river Scheldt, which flowed through the district, formed the boundary line between Neustria and Austrastia, in consequence of which the northern and south-western parts of the territory comprised under the term F., although its population was decidedly Germanic, came to belong to France, while the s.e., although to a large extent non-Germanic, was after 1007 included in the German empire. F. obtained its name from the *Vländergau* (*pagus Flandrensis*, the district around Bruges and Sluis), whose counts had been made wardens of the north-eastern coasts of France at the period of the incursions of the Normans, in the latter half of the 9th c., and who extended the name of their hereditary possessions to the whole district which they governed. The first count or markgraf of the country is said to have been Baldwin, surnamed *Bras de Fer* (iron-arm), who married Judith, the daughter of king Charles the bald of France, and widow of Ethelwulf, king of England, and afterwards received the newly created "mark" or county, in 864, as a hereditary fief from his father-in-law. He extended his territories by the addition of Artois, which was held by his successors until Philippe Auguste reunited it to France. He died in 879, but not until he had inaugurated the industrial greatness of F. by introducing into it a great number of workmen skilled in the manufacture of woolen and other goods. Baldwin IV., or the bearded, one of the successors of Baldwin *Bras de Fer*, received in fief from the emperor Henry II. the burgraviate of Ghent, Walcheren, and the islands of Zealand, and thus became a prince of the German empire. He was succeeded by his son Baldwin V., or the pious (1036–67), who increased his possessions by the addition of the German territory between the Scheldt and the Dender, belonging to the duchy of Lower Lorraine. To this he added Tournay, the supremacy over the bishopric of Cambray (to which, till the erection of the new bishopric of Arras, the county of Flanders had been ecclesiastically subordinate), and the county of Hainault. During the middle ages, F. figured prominently in the political affairs of Europe—the counts of F. being more powerful and wealthy than many European kings. Baldwin IX., the founder of the Latin kingdom at Constantinople, died in 1206, leaving two daughters, one of whom died without children; the other bequeathed Hainault to John of Avennes, her son by her first marriage; and F. to Guy Dampierre, her son by a second marriage. Meanwhile, the industrial prosperity of the cities of F. had become so great, that the citizens began to feel their own power, and to claim independence. They formed republican communities like the free cities of Germany, with this difference, that they admitted the nominal suzerainty of the counts. But they were not afraid to take up arms in defense of their liberties against their nominal masters. Witness the insurrection headed by Jakob van Artevelde (q.v.) against the cruel government of count Louis I. On the marriage of Marguerite, the daughter and heiress of Louis II., count of F., to Philip the bold of Burgundy, the country was united to the Burgundian territories in 1384, and afterwards shared the fortunes of that duchy. The dukes of Burgundy brought great part of the former duchy of Lower Lorraine under their dominion, and thus laid the foundation for the subsequent union of the states of the Netherlands, in which F. continued to form one main component part. On the death of Charles the bold, these territories passed, in 1477, to the house of Hapsburg, by the marriage of his daughter Mary to the archduke Maximilian. After Burgundy had passed with king Philip II. to the Spanish line of the house of Hapsburg, the territory of F. was considerably diminished, as not only was the portion called Dutch F. transferred to the estates-general by the peace of Westphalia, but, in the time of Louis XIV., France seized upon another portion of F., as also a part of Hainault, Cambray, and Artois, and was confirmed in her possession by the peace of Aix-la-Chapelle, of Nimeguen, and of Utrecht. By the last, and by the treaty of peace concluded at Rastadt, the remains of the Spanish Netherlands again fell into the hands of the house of Austria. In 1794, F., like the other provinces of Belgium, was incorporated with the French republic, and afterwards with the empire, and formed the departments of Lys and Escaut; the congress of Vienna, however, conferred these portions on the new kingdom of the

Netherlands, with which they remained united till the formation of the kingdom of Belgium (q.v.). The Belgian portion of F. is now divided into the provinces of East and West F. (q.v.).—Compare Praet, *Histoire des Comtes de Flandres, et de l'Origine des Communes Flamandes* (Brussels, 1828); Le Glay, *Histoire des Comtes de Flandres jusqu'à l'Avènement des Ducs de Bourgogne* (2 vols., Paris, 1843); Kervyn van Lettenhoven, *Histoire de Flandres* (6 vols., Brussels, 1847–51), etc.

FLANDERS, EAST, a province in the n.w. of Belgium, is bounded on the e. by the provinces of Antwerp and Brabant, on the s. by that of Hainault, on the w. by that of West F, and on the n. by the Dutch province of Zealand. It has an area of 1146 sq.m., and a population which amounted in 1873 to 854,366, or about 736 a sq. mile. East F. is the most populous province of the most populous country in Europe. See BELGIUM. It is watered mainly by the Scheldt, and by its affluents, the Lys and the Dender. The surface is low and level. The soil has been rendered extremely fertile by means of spade cultivation and an excellent manuring system. Besides the ordinary varieties of grain, potatoes, flax, hemp, and hops are produced in great quantity. The district in the n.e. of the province, between the towns of Antwerp and Ghent, is celebrated as a flax growing quarter. The manufactures are chiefly lace, damasks, linens, woolens, bobbinet, silk, and cordage; sugar-refining, brewing, and distilling are also carried on. Chief towns, Ghent, Alost, and Dendermonde.

FLANDERS, WEST, the most western province of Belgium, is bounded on the n. by the North sea, and on the w. and s. by France. Its area is 1237 sq.m., and its pop. in 1873 amounted to 682,921. Its chief rivers are the Lys and the Iser; but it is watered by numerous smaller streams, and is intersected by many important canals. Its surface is flat, with sandy hills in the s. and along the coast; and its soil sandy, but well cultivated and productive. It has fewer products and manufactures than East Flanders. Chief towns, Bruges, Courtrai, and Ostend.

FLANDRIN, JEAN HIPPOLYTE, 1809–64; a French painter, one of three brothers. AUGUSTE, the oldest, was a professor in Lyons, where he died in 1840. HIPPOLYTE, the second, and PAUL, the youngest, studied with Ingres in Paris, who was not only their tutor, but a life-long friend. Paul is now one of the leaders of the modern landscape school of France. In 1832, Hippolyte took the grand prize at Rome, awarded for his picture of the "Recognition of Theseus by his Father." In that city he produced "St. Clair Healing the Blind," "Jesus and the Little Children," "Dante and Virgil visiting the Envious Men struck with Blindness," and "Euripides writing his Tragedies." His fame rests, however, upon his monumental decorative paintings in Parisian churches. In 1856, he was made a member of the académie des beaux-arts.

FLANGE, a rim or projection upon a tube or cylinder of metal or other material, to serve as a bearing, or afford means of fixing it; for example, the projecting rim on the tires of the wheels of railway-carriages is called a flange.

FLANK (the side), a word used in many senses in military matters. *Flanks of an army* are the wings, or bodies of men on the right and left extremities, prepared to close in upon an enemy who shall attack the center. *Flank files* are the soldiers marching on the extreme right and left of a company or any other body of troops. *Flank company* is the company on the right or left when a battalion is in line; the grenadier and light infantry companies usually occupy these positions, and are known as flank companies, whether with the remainder of the regiment or not. A *flanking party* is a body of horse or foot employed in hanging upon and harassing the flank of an enemy's force —Flank, as applied in fortification, will be best described under that article (q.v.). The *flanks of a frontier* are certain salient points in a national boundary, strong by nature and art, and ordinarily projecting somewhat beyond the general line. The effect of these flanks is to protect the whole frontier against an enemy, as he dare not penetrate between them, with the risk of their garrisons, reinforced from their own territories, attacking his rear, and cutting off communication between him and his base. Silistria and Widin were flanks of the Turkish frontier during Omar Pasha's campaign in 1853 and 1854. Similarly, in the event of an invasion of England from the coast of Sussex or Kent, Portsmouth and Chatham would be formidable flanking garrisons, which would almost necessarily have to be subdued before the invader could march on London.

In evolutions, "to flank" is to take such a position with troops as either to aid one's own army in an attack on the enemy, by leading the latter to suppose that his flanks are in danger in his present position, or to prevent him from advancing on one's comrades by threatening his flanks if he should do so. To *outflank* is to succeed by maneuvers in commanding the flank of an enemy who has been, on his part, endeavoring to flank one's own force.

FLANNEL (Welsh, *gwlanen*, from *gwlan*, wool, allied to Lat. *lana*), a woolen fabric, differing from broadcloth and most other woolen fabrics in being woven of yarn more loosely twisted, and having less dressing. The best F. is made in the neighborhood of Welshpool and Newtown, in Wales, from the wool of the Welsh mountain-sheep, and is commercially known as Welsh flannel. Large quantities are also made in w. Lancashire, w. Yorkshire, and the neighborhood of Leeds. A more closely spun and woven F., used for cricketing and rowing shirts, etc., and dyed and printed with various

colors and patterns, is made in the w. of England cloth-making district, in the vicinity of Stroud, in Gloucestershire. Fine light F. of this kind is made in France and Belgium; some of this is twilled, and approaches nearly in quality to French merinoes, but is much softer. The demand for this sort of fancy-shirting F. has of late become considerable, and has led to the production of many varieties, which, though bearing the name of F., vary so materially from the original Welsh F., that they can scarcely be included with them under any very general definition. Coarse F., called *Galways*, is made in Ireland, and is chiefly used by the peasantry of the country.

FLAT, a musical character, shaped thus ♭, which, when placed before a note, lowers that note half a tone. When placed at the beginning of a piece of music, it denotes that all the notes on the line or space on which it is placed, with their octaves above and below, are to be played flat.

FLATBUSH, a t. in Kings co., N. Y., adjoining the city of Brooklyn; pop. '75, 6,940. It contains the county almshouse, nursery, hospital, and lunatic asylum, an academy, a town-hall, a free public school, four churches, and the county military parade ground which adjoins Prospect park, Brooklyn. Flatbush is connected with the Brooklyn ferries by horse and steam railroads. It is remarkable for the size and elegance of many of its old dwellings. Flatbush was the scene of the important "Battle of Long Island," Aug. 27, 1776, when the British were victorious, compelling Washington to retire above New York, and leaving that city to English occupation during the entire war.

FLAT-FISH, a popular name of the fishes of the family *pleuronectidæ* (q.v.), as the flounder, plaice, sole, turbot, halibut, etc.; which have the body much compressed, and the sides unsymmetrical, swimming on one side. It is sometimes extended in its signification so as to include skates and other fishes of the ray (q.v.) family, which are very different, being cartilaginous fishes, quite symmetrical, and swimming on the belly, although, like the *pleuronectidæ*, generally keeping close to the bottom. It is never applied to the much compressed symmetrical fishes, such as the dory, which swim in the ordinary posture of fishes, the dorsal edge upwards, the ventral downwards.

FLATHEAD PASS, a depression in the Rocky mountains in Montana, 6,769 ft. above tide. It has long been known and used by the Shoshone, Bannock, and Flathead Indians.

FLATHEADS, signifying certain North American Indians who artificially compress the heads of their children, as the Chinese compress the feet, by various mechanical contrivances. The deformity is much like that observed in ancient Peruvian heads. The forehead is flattened, and the upper and middle parts of the face are pushed back so that the orbits are directed upwards; the head is so distorted that the top is transformed into nearly a horizontal plane, the width of the skull and the face are much increased; and the sides are unsymmetrical. The tribes addicted to this practice comprise all those in the north-western section of British America, in Oregon, and Washington territory. A newly-born infant has a pad of grass or a flat board over the forehead, often so that the child is entirely blinded, which is retained until the required shape is produced. But, according to Pickering, the victims outgrow the deformity, so that at adult age it is seldom observable. No doubt the custom originated in some connection with religious observance, for slaves are not permitted to practice it. It is somewhat remarkable, so travelers and inquirers testify, that the intellect is not at all affected by this practice; that the flat-headed tribes are perhaps rather superior in shrewdness to Indians who have normal heads. The Chinooks, along Fuca sound in British Columbia, are the best known of the Flat-head tribes. It is somewhat singular that the term "flat-heads" is persistently applied to a tribe who do not use the practice at all—the Selish, residing on tributaries of Clarke's river. This small band was converted to Christianity about 1840 by father De Smet. At that time they were in a wretchedly poor condition, but he inspired them with hope, and they rapidly improved, making progress in the cultivation of the soil, and adopting the dress and to some extent the ways of white people. Of late years, however, their situation has become unfavorable. Treaties have been made with them, usually to the advantage of the "white brother," and they have been moved from place to place, have lost by wars with other tribes, and seem doomed to early extinction.

FLATTERY, Cape, a headland of Washington territory, on the Pacific coast of the United States, marks the s. side of the entrance of the strait of Juan de Fuca. It is in lat. 48° 24′ n., and in long. 124° 40′ w.—Another headland of the same name is found on the e. coast of Australia, in lat. 14° 52′ s., and long. 145° 20′ east. It is about 30 m. to the n. of Endeavor bay.

FLATULENCE, distention of the stomach or bowels by the gases formed during digestion. See Indigestion.

FLAVEL, John, 1627–91; an English non-conformist divine, the son of "a painful and eminent minister" in Worcestershire. He was educated at Oxford, and was curate at Deptford and Dartmouth. Under the act of uniformity, he was ejected from his living, but for some time he continued to preach and administer the sacraments privately.

After the fall of the Stuarts, he was minister of a non-conformist church at Dartmouth. His works were popular for a long time.

FLAVIAN I., Saint, 320–404; Patriarch of Antioch. Though inheriting great wealth, he devoted his riches and his talents to the service of the church. He was the successor of Meletius as patriarch. During his administration, a serious sedition occurred in the streets of Antioch, 387 A.D., in which the statues of Theodosius and the empress were overturned; but Flavian's influence with the emperor prevented the punishment of the rebellious people.

FLAVIAN II., Saint, d. 518; Patriarch of Antioch; successor of Palladius. After his death, he was enrolled among the saints of the Greek church, and also, after considerable opposition, among those of the Latin church.

FLAVIAN, Saint, Patriarch of Constantinople, succeeding Proclus in 447. He was deposed in 448 by the council of Alexandria, and he is supposed to have died from injuries inflicted by Dioscorus, the president of the council. He is enrolled in the martyrology of the Latin church, his day being Feb. 18.

FLAVINE, or Flavin, is a yellow coloring matter employed in dyeing, and imported in the condition of extract. It is understood to be the coloring matter of bark (quercitron bark), and is used in place of quercitron bark. When treated with hot water, F. yields a yellow turbid solution, which, on settling, deposits a yellow-brown powder. When employed in dyeing, the cloth is first treated with an aluminous mordant (see Calico-printing); and on subsequent immersion in the solution of F., a fine yellow color is fixed on the cloth. The coloring power of the extract F. as imported is so great that one ounce is equal in dyeing qualities to one pound of quercitron bark.

FLAX, *Linum*, a genus of plants comprising the greater part of the natural order *linaceæ;* an exogenous order allied to *geraniaceæ* and *oxalideæ*, and consisting of annual and perennial herbaceous plants, with a few small shrubs. There are about ninety known species of this order scattered over the globe, but most abundant in Europe and the n. of Africa. Their leaves are simple, entire, without stipules, and generally alternate. The Common Flax or Lint (*L. usitatissimum*) is an annual; a native of Egypt, of some parts of Asia, and of the s. of Europe, not truly indigenous in Britain, although now naturalized, and often occurring in cornfields, which is the case also in many parts of the world. The most common variety of the F. plant has a very slender erect stem, 2 or 3 ft. high, branching only near the top, so as to form a loose corymb of flowers. The leaves are small, distant, and lanceolate; the flowers of a beautiful blue, rarely white, rather broader than a sixpence; the petals slightly notched along the margin; the sepals ovate, 3-nerved, ciliated, destitute of glands; the capsules scarcely longer than the calyx, not bursting open elastically, but firmly retaining their seeds, which are dark brown, glossy, oval-oblong, flattened, with acute edges, pointed at one end, and about a line in length. Another variety, however, is cultivated to some extent in many parts of Europe, so different, that some botanists account it a distinct species (*L. humile* or *L. crepitans*), which is less tall, is more inclined to branch, and is particularly distinguished by its capsules, twice as long as the calyx, and bursting open elastically when ripe. The seeds are also larger and paler. This variety is called *Springlein* and *Klanglein* by the Germans, the one name referring to the elastic bursting of the capsules, the other to the sound which accompanies it. The former variety is known to them as *Winterlein*, being often sown in the end of autumn in elevated districts where the summer is too short for spring-sown F., and also as *Schlieszlein* and *Dreschlein*, from its close capsules and the thrashing needed to separate the seed. The *Springlein* produces a finer, whiter, and softer fiber than the other, but shorter, and it is therefore not so extensively cultivated. There are many sub-varieties, to which and their different qualities no such attention has been paid, in Britain at least, as to those of other important cultivated plants.

This plant is highly valuable both for the fibers of its inner bark and for its seeds. The fibers of the inner bark, when separated both from the bark and from the inner woody portion of the stem, are Flax or Lint, the well-known material of which Linen thread and cloth are made, and used equally for the finest and for the coarsest fabrics, for the most delicate cambric or exquisite lace, and for the strongest sail-cloth. The seeds yield by expression the *drying* fixed oil called Linseed Oil, so much used for mixing paints, making varnishes, etc.; whilst the remaining crushed mass is the linseed cake, or Oil-Cake, greatly esteemed for feeding cattle, and when ground to a fine powder, becomes the Linseed Meal so useful for poultices. Linseed is sometimes used in medicine, as an emollient and demulcent in irritations of the pulmonary and of the urinary organs, and of the mucous membranes generally, deriving its value for this purpose from a mucilage which it contains, and which is extracted by hot water, making *linseed tea.* The fiber of F. is the ultimate material from which paper is made, and linseed oil is used in the manufacture of printers' ink. No plant not yielding food is more useful to man than the F. plant.

It has been cultivated from the earliest historic times. It is mentioned in the book of Exodus as one of the productions of Egypt in the time of the Pharaohs; and it has been recently ascertained by microscopic examination, that the cloth in which the mummies

of Egypt are enveloped is linen. Solomon purchased linen yarn in Egypt. Herodotus speaks of the great F. trade of Egypt. Great quantities of F. are grown in that country at the present day; its cultivation is also very extensively carried on in some parts of Europe and of North America. The proportion of F. to other crops in Britain is probably smaller at present than it was at a former period, but an increase of its cultivation has been strongly recommended by persons whose opinion is entitled to great regard, and particularly in Ireland, where, however, it is more extensively cultivated than either in England or Scotland. It has the advantage of giving employment not only to an agricultural but to a manufacturing population. F. is more extensively and more successfully cultivated in Belgium than in any other European country, particularly in southern Brabant, Hainault, and w. and e. Flanders, in which the most beautiful F. in Europe is produced, employed for the manufacture of the famous Brussels lace, and sold for this purpose at about £100 to £180 per ton, the crop when prepared for the market sometimes exceeding in value the land on which it was produced. The village of Rebeque is distinguished for the production of this precious flax. The greatest care is bestowed on its cultivation, and to this its excellence is probably in a great measure to be ascribed. Not a weed is to be seen, and the care and labor are equal to those of gardening. F. is extensively grown in the countries on the southern shores of the Baltic, and both the fiber and seed are largely imported from them into Britain. Besides the F. raised at home, the United Kingdom imported in 1875, 88,253 tons, dressed and undressed.

F. has been cultivated from time immemorial, as a winter crop, in India, but only for its seed, and not at all for its fiber. This remarkable circumstance is supposed by Dr. Royle to be owing to the existence of the cotton plant in that country, the fiber of which more readily offers itself to view on the bursting of the pod. But Dr. Royle also states his opinion, that the climate of the greater part of India is unsuitable for the production of the fiber of F.; and the variety cultivated in India is only about a foot or 18 in. in height, much branched, and yielding a very worthless fiber, whilst it is loaded with capsules, and the seeds yield a larger proportion of oil than those of F. grown in Europe. It is sometimes sown as an edging around fields.

Much depends on the thickness of sowing. F. must be sown thick to yield a fine fiber; but when intended to produce a fiber for coarser purposes, the plants ought to have more room. For the finest fiber, also, they must be pulled before the seed is ripe; but a coarser fiber and a crop of linseed are often much to be preferred by the farmer. The crop is always *pulled* up by the roots.

The diminished cultivation of F. in Britain, after agriculture began to improve, is to be ascribed in part to the prevalence of the opinion that it is a very exhausting crop for the land. This has been said to be particularly the case when the seed is ripened. But the introduction of new manures has rendered this objection less important than it formerly was; and it has been found that the refuse of F. itself is not a bad manure, and that the water in which it has been steeped is a good liquid manure. The water of flax-steeping pits or ponds is often strong enough to kill the fish of rivers into which it is allowed to flow.

The capsules (*bolls*) of F. are torn off, after it is pulled, by a sort of combing called *rippling* (see FLAX-DRESSING). Great care is requisite to dry them, and to keep them perfectly dry. For the subsequent processes, see LINSEED.

Besides the common F., several other species are occasionally cultivated for their fiber, but are comparatively of very little value.

The *linaceæ* are, in general, plants of elegant appearance and with flowers of much beauty; some of them have flowers larger than common F., and some are not unfrequent ornaments of our green-houses. *Radiola millegrana*, all-seed, is one of the smallest of British phanerogamous plants.

PURGING FLAX (*linum catharticum*) is a graceful little annual with branching stem, opposite leaves, and small white flowers, common in fields and meadows throughout Britain and most parts of Europe. It possesses purgative and diuretic properties, owing to the presence of a substance which has been called *linin*. As a domestic medicine, a handful of the fresh herb is often administered, infused in whey; and it has a popular reputation in rheumatism.

FLAX (*ante*), cultivated in the United States less for its fiber than for the oil which is produced from the seed. When the supply of cotton was cut off during the war of the rebellion, efforts were made in some quarters to substitute flax and to spin and weave it by means of the machinery employed in the manufacture of cotton fabrics; but the result of these efforts was not satisfactory, the two products requiring essentially different treatment. The plant will grow in almost any part of the United States, but it needs a strong, rich soil, and careful manipulation at every stage of its production and manufacture. It requires a greater amount of labor than almost any other crop, and unless extreme care is exercised at every step, the value of the crop will be seriously impaired. Flax has been cultivated in this country from its earliest settlement. According to the census of 1870, the total amount of the production here was 27,138,034 lbs. Of this amount, 17,880,624 lbs. were produced in Ohio, 3,670,818 in New York, and 2,204,606 in Illinois. The total production of flax-seed in the same year was 1,730,444 bushels,

and of this 681,849 were produced in Ohio. In 1872, the number of acres sown to flax in Ohio was 85,863; the production was 783,000 bushels of seed and over 24,000 lbs. of fiber. There were in 1870 in the United States 90 flax-dressing establishments, the products of which were valued at $815,000. Of these establishments, 46 were in New York, and 27 in Ohio. The importation of raw flax into the United States in the year ending June 30, 1878, was 4,171 tons, valued at $1,187,737. The importation of flax manufactures in the same year, chiefly from England and Scotland, amounted to $20,428,391.

FLAX, NEW ZEALAND, a valuable fiber quite different from common flax, and obtained from the leaf of an endogenous, instead of the stem of an exogenous plant. The plant yielding it is *phormium tenax*, often called N. Z. F., and sometimes flax lily and flax bush. It belongs to the natural order *liliaceæ*, and is a perennial plant, a native of New Zealand and Norfolk island; its leaves resemble those of an iris, are from 2 to 6 ft. long and 1 to 2 or 3 in. broad. The flowers are produced in a tall branched panicle; are numerous, brownish yellow, not very beautiful; the fruit is a three-cornered capsule with numerous compressed jet-black seeds. The fiber of the leaves is both very fine and very strong, and was used by the New Zealanders, before their country was discovered by Europeans, for making dresses, ropes, twine, mats, cloth, etc. N. Z. F. is imported into Britain for making twine and ropes; and the plant is cultivated in its native country. Its cultivation has also been attempted in some parts of Europe; but the winters of Europe, except in the s., are too cold for it. To obtain the fiber, the leaves are cut when they have attained their full size, and usually macerated for a few days in water. But the New Zealanders procure the fiber in its greatest perfection, very long and slender, shining like silk, by a more laborious process, and without maceration; removing the epidermis from the leaf when newly cut, separating the fibers by the thumb-nails, and then more perfectly by a comb.

The roots are purgative, diuretic, sudorific, and expectorant; a good substitute for sarsaparilla.—The leaves, when cut near the root, exude a viscid juice, which becomes an edible gum.—The New Zealanders prepare a sweet beverage from the flowers.

FLAX-DRESSING. When the seeds are beginning to change from a green to a pale brown, is the best time for pulling flax. Where the crop grows of different lengths, these lengths should be pulled and kept separately, uniformity in this respect being of great value in the after-processes.

The process first gone through after pulling is *rippling*—which consists in tearing off the bolls by pulling the stalks through a series of iron teeth 18 in. long, placed within a distance of half an inch of each other. These are fastened in a block of wood, which is placed at the end of a plank or long stool on which the operator sits.

The next process is to obtain the flaxen fiber or lint free from the woody core, or *boon*, of the stem. This is effected by steeping the bundles in water till the boon begins to rot, in which state it is readily separated from the fiber. The operation is called rotting or *retting*, and requires to be managed with great care, as by continuing it too long, decomposition might extend to the fiber, and render it useless; while by discontinuing it too soon, the separation could not be effected with sufficient ease. The time is generally determined by the nature and temperature of the water, and the ripeness of the flax—decomposition taking place more rapidly in soft stagnant water than in running streams, in which the retting is sometimes conducted. After being sufficiently steeped, the flax is spread out on the grass, to rectify any defect in the retting, and ultimately to dry it for the breaking. In some districts, it is the practice to conduct the retting entirely on the grass—a process known as dew-retting, in contradistinction to water-retting. This is a safer and less offensive method, but it requires much longer time, and in a country where land is valuable, would become very expensive. On the whole, the mixed method of retting is preferable—that is, to steep till decomposition of the boon is well advanced, and then to complete the process on the grass. It has been attempted to separate the fiber by machinery, without subjecting the flax to retting; but the article so produced has hitherto been rejected as inferior in quality.

To avoid the delays and uncertainty dependent upon the old processes of retting or watering, plans have been recently introduced, bringing the operation more under control, like the other processes of our manufactures. The methods which have been adopted, and are now working with success, are known as Schenk's and Watt's. By the first of these, the flax is placed in vats, in which it is kept down by means of strong frame-work. Water is allowed to pass into the vats, to become absorbed by the flax; steam is next admitted, till the temperature of the water is raised to, and maintained at, about 90°. Acetous fermentation ensues in a few hours; and after being maintained for about 60 hours, the decompasition of the gummy or resinous matter in the stalk is completed. The mucilage water is next withdrawn from the vat, and the flax taken out, separated and dried either in the open air or in desiccating rooms, according to circumstances. In Watt's process, the flax is placed in a chamber provided with a perforated false bottom; the top is double, and filled with water to act as a condenser. Steam being admitted to the case, the first result is the freeing of the flax from certain volatile oils. The steam rising to the top of the chamber is condensed by contact with it, and falls in showers on the flax beneath—a decoction of the extracted matter is thus

obtained. In 36 hours, the process is completed; and the flax taken out, is passed between rollers in the direction of its length, which presses out the water and decomposed gum, and splits and flattens the straw. By this process, all that the plant takes from the land is saved—the seeds being available as food for animals, and the chaff and refuse water as manure.

Prepared by either of the plans, the flax is now ready to be freed completely of its woody particles. This is effected by *scutching*. Previous to this, however, the flax is passed through a *brake* or revolving rollers, in order thoroughly to crack the boon. The brake, worked by manual labor, consists of a frame, in the upper side of which are a number of grooves; a moveable piece is hinged at one end, and provided with a similar grooved piece on its lower side, but so placed that the projections pass into the hollows of the lower. The flax, placed between these, and struck by bringing down the hinged part, is broken, but the fiber remains uninjured.

In the flax-breaking machine, the flax is passed through a series of horizontal fluted rollers; the flutes do not touch, thus preserving the fiber while breaking the boon. In continental countries, scutching is almost invariably performed by hand, the flax being held in a groove made in an upright stand, and struck by a flat blade. Machine-scutching is much more certain and expeditious than hand-scutching, and is, in consequence, fast superseding it in this country. After passing through the breaking-machine, the flax is subjected to the action of a series of knives, attached to the arms of a vertical wheel; these knives strike the flax in the direction of its length. The process is gone through three times before the flax is ready for the market. Although machine-scutching is expeditious, it is not capable of that pliant adaptation to the varying nature of the flax to be operated upon, which is obtained in hand-scutching. The effect of machine-scutching is to produce fineness by reducing and impairing, rather than sustaining, the character of the fiber—namely, the length and fineness of its "staple" or fiber. To remedy these defects, scutching by means of revolving brushes has been introduced. This divides the fiber without tearing it. The subsequent manufacturing operations will be noticed under LINEN AND LINEN MANUFACTURES.

FLAXMAN, JOHN, the greatest of English sculptors, was b. at York, 6th July, 1755. At the age of 15, he became a student in the royal academy, but never worked in the studio of any master. In 1782, he married Miss Ann Denman, a lady of superior gifts and graces, who soon began to exercise a beneficial influence upon his studies. Accompanied by her, he went in 1787 to Italy, where, by degrees, he attracted the attention of all lovers of art. This was still more the case after his return to London in 1794. He was elected an associate of the royal academy in 1797; royal academician in 1800; and, in 1810, was appointed professor of sculpture to that institution. After the death of his wife in 1820, he withdrew from society, and died 7th Dec., 1826. F.'s most celebrated works are his "Outlines to Homer's Odyssey" (Rome, 1793), and "The Iliad" (Lond. 1795), and his illustrations of Dante and Æschylus. Many of his works display wonderful grandeur of composition, and a pure and noble style. He was one of the first of those who, following the example of Winckelmann, strove to penetrate to the true spirit of antique art, in opposition to the false taste of the time. The study of vase paintings, and of the Pompeian mural pictures, then just revived, led him to abandon the sickly mannerism of his predecessors for the severe simplicity of the antique, and he may with justice be styled the author of modern *rilievo* (see ALTO-RILIEVO). His works are not, however, all of equal value, and, in general, it may be said that his skill in modeling was not equal to his inventive genius. The poetry of his conceptions is of a high order. F. contributed much toward bringing the outline style, now so popular, into general use. Of his sculptures, the best known in England are his bas-relief monument to the poet Collins at Chichester, the monument to lord Mansfield, and that to the Baring family at Micheldean church, in Hampshire. His model for the shield of Achilles, taken from the 18th book of the *Iliad*, is particularly worthy of admiration. F.'s private collection is now in university college, London, in the gallery known as *Flaxman Hall*.

FLEA, *Pulex*, a Linnæan genus of apterous insects, now commonly regarded by entomologists as constituting a distinct order, *suctoria*, *siphonaptera*, *aphaniptera*. The species are not numerous, and little subdivision of the genus has been attempted. It has been suggested as probable, that further investigation may lead to a recognition of the fleas as belonging to some of the larger orders, with parts modified to suit their parasitical life. All the species are very similar to the COMMON FLEA (*P. irritans*), which is plentiful in all parts of the world, living by sucking the blood of man, and of some species of quadrupeds and birds. It abounds particularly in the nests of poultry, pigeons, and swallows, and wherever sand and dust accumulate in the chinks of floors, etc.; and it is to be found also plentifully in beds, wherever cleanliness is neglected. The abundance of fleas in some countries is an intolerable nuisance to travelers, and also to residents. Such is said to be particularly the case in many parts of Australia, where the general dryness and warmth encourage their growth to an extent against which the precautionary measures of housewives are almost entirely unavailing. The female F. is rather larger than the male, but the sexes are otherwise very similar. The head is small, very compressed, rounded above, and has on each side a small round eye. The mouth has two lancet-like mandibles, the maxillæ being represented by two conical

scales, the mandibles and maxillæ forming a suctorial beak, with a slender bristle-like tongue, the whole inclosed between two three-jointed plates. The thorax consists of three segments, the second and third of which bear a scale on each side; the scales are regarded as rudimentary wings. There is no marked division between the thorax and the abdomen, which consists of nine segments, much larger than those of the thorax, but much compressed. The whole body is covered with a tough integument. The activity of the F., its power of leaping, and its extraordinary strength, are well known. Its strength has been sometimes applied to the drawing of miniature carriages, canon, etc., which the public have been invited to witness through a magnifying-glass, as an amusing spectacle. Fleas undergo a complete metamorphosis. The female lays about a dozen eggs of a white color, and slightly viscous. The larva is a lively little worm, at first white, afterwards reddish, and destitute of feet. When about to change into a pupa, it incloses itself in a little silk cocoon, from which emerges the perfect flea. Cleanliness and careful attention are the principal means of keeping beds and houses free of fleas; but where these are found insufficient, as is apt to be case in some climates, and in cottages where there is much wood-work with gaping joints, certain strongly aromatic plants are employed, of which the odors appear to be detestable to them, as the different *compositæ* known by the name of fleabane, and also wormwood, the merits of which last are thus extolled by Tusser:

> "While wormwood hath seed, get a handful or twaine,
> To save against March, to make flea to refraine;
> Where chamber is sweeped, and wormwood is strown,
> No flea for his life dare abide to be known."

Other species of fleas infest particular animals, as the dog, fox, mole, etc.—The chigoe (q.v.), or jigger of the West Indies, nearly allied to the true fleas, is far more troublesome than any of them.

FLEA'BANE, *Pulicaria*, a genus of plants of the natural order *compositæ*, suborder *corymbiferæ*, having hemispherical imbricated involucres and yellow flowers; the whole plant emitting a peculiar aromatic smell, sometimes compared to that of soap, which is said to be efficacious in driving away fleas. Two species are found in England, one of which (*P. dysenterica*), common in moist places, with oblong leaves, stem 12 to 15 in. high, cottony, and bearing panicled flowers, has a considerable reputation in diarrhea and dysentery. The Russian soldiers, in the expedition to Persia under gen. Keith, were much troubled with dysentery, which was cured by this plant.—*Conyza squarrosa*, also called F., belongs to a nearly allied genus.

FLECHE, LA, a t. of France, in the department of Sarthe, is agreeably situated on the right bank of the Loir, 24 m. s.s.w. of Le Mans. It is a well-built town, and has three principal streets, which are wide and well paved. Its principal building is the military school, with a library of 15,000 volumes, destined for the education of the sons of poor officers, or of soldiers who have highly distinguished themselves. The building now occupied by the school was once a royal palace, and was built by Henry IV. It was subsequently given by him to the Jesuits, and used by them as a Jesuit college. Here prince Eugene, Descartes, and Picard the astronomer, were educated. F. has some trade in corn, hay, and wine, also manufactures of linen, hosiery, and gloves. Pop. '76, 7,468.

FLÉCHIER, ESPRIT, 1632–1710; a French preacher of the congregation of Christian Doctrine. In 1659, he was professor of rhetoric at Narbonne. His chief celebrity arose from his eloquence as an orator, but he was also in great favor with his contemporaries for his political compositions, among which were *Carmen Eucharisticum*, celebrating the peace of the Pyrenees; one on the birth of the dauphin; and *Circus Regius*, describing a tournament given by Louis XIV. in 1662. He also wrote *Memoires sur les Grand Jours d'Auvergne*, in which he relates, in half romantic and half historic form, the proceedings of that extraordinary court of justice. His sermons increased his reputation, which was afterwards raised to the highest pitch by his funeral orations. His discourse on the death of Mme. Montausier secured his admission to the academy at the same time with Racine. Honors were bestowed upon him until he became bishop of Nismes. There he had occasion for the daily exercise of his greater qualities—gentleness and moderation. The edict of Nantes had been repealed two years before: but the Calvinists were still very numerous at Nismes, and the sincerity of the conversion of such as had made abjuration was doubtful at best. Fléchier, by his prudent conduct, in which zeal was tempered with charity, succeeded in bringing over some of them to his views, and made himself esteemed and beloved even by those who declined to change their faith. During the troubles in the Cevennes, he softened to the utmost of his power the rigor of the edicts, and showed himself so sensible to the evils of persecution, and so indulgent even to what he regarded as error, that his memory was long held in veneration amongst Protestants of that district. In the famine which succeeded the winter of 1709, he did much to alleviate the prevalent distress by assisting the poor in his diocese without regard to their religious tenets, declaring that all alike were his children.—[From *Encyc. Brit.* 9th ed.]

FLECK'NOE, RICHARD, the date of whose birth is unknown, is said to have been an Irish Roman Catholic priest. He came to London, mingled in the wars of the wits,

and wrote several plays, all of which are now forgotten. He died in 1678. F. came under the lash of Dryden, whose satire, entitled *Mac Flecnoe*, is partly the model of Pope's *Dunciad* (q.v.), and will be remembered as long as the great satirist is remembered. From those who are acquainted with our extinct literature, we have the assurance that F. has been hardly dealt with; that though he did not rise to the rank of Dryden as a poet, he was the author of several fugitive pieces, not without grace, fancy, and happy turns of expression. Among his dramatic pieces are *Ermina, or the Chaste Lady; Love's Dominion* (printed in 1654, and dedicated to Cromwell's favorite daughter, Mrs. Claypole); and *The Marriage of Oceanus and Britannia*. His *Miscellanea, or Poems of all Sorts*, appeared in 1658.

FLEET (that which floats), a collection of ships, whether of war or commerce, for one object or for one destination. The diminutives of fleet are "division" and "squadron." In the royal navy, a fleet is ordinarily the command of an admiral or vice-admiral.

FLEET MARRIAGES. The practice of contracting clandestine marriages was very prevalent in England before the passing of the first marriage act (see MARRIAGE). The chapels at the Savoy and at May Fair, in London, were long famous for the performance of these marriages; but no other place was equal in notoriety for this infamous traffic to the Fleet prison. It must be observed that, before the passing of the 26 Geo. II. c. 33, there was no necessity in England for any religious ceremonial in the performance of marriage, which might be contracted by mere verbal consent. Hence it was not in virtue of any special privilege existing within the liberty of the Fleet that marriages at that place became so common; but rather from the fact, that the persons by whom they were performed, having nothing to lose either in money or character, were able to set at defiance the penalties enacted from time to time with a view to restrain this public nuisance. The period during which these marriages were in greatest repute was from 1674 to 1754. The first notice of a Fleet marriage is in 1613, in a letter from alderman Lowe to lady Hickes, and the first entry in a register is in 1674. Up to this time it does not appear that the marriages contracted at the Fleet were clandestine; but in the latter year, an order having been issued by the ecclesiastical commissioners against the performance of clandestine marriages in the Savoy and May Fair, the Fleet at once became the favorite resort for those who desired to effect a secret marriage. At first the ceremony was performed in the chapel in the Fleet; but the applications became so frequent, that a regular trade speedily sprung up. By 10 Anne, c. 19, s. 176, marriages in chapels without banns were prohibited under certain penalties, and from this time, rooms were fitted up in the taverns and the houses of the Fleet parsons, for the purpose of performing the ceremony. The persons who celebrated these marriages were clergymen of the church of England, who had been consigned for debt to the prison of the Fleet. These men, having lost all sense of their holy calling, employed touters to bring to them such persons as required their office. The sum paid for a marriage varied according to the rank of the parties, from half-a-crown to a large fee where the liberality and the purse combined to afford a large reward. During the time that this iniquitous traffic was at its height, every species of enormity was practiced. Young ladies were compelled to marry against their will; young men were decoyed into a union with the most infamous characters; and persons in shoals resorted to the parsons to be united in bonds which they had no intention should bind them, and which were speedily broken to be contracted with some new favorite. The sailors from the neighboring docks were steady patrons of this mode: it was stated by the keeper of one of the taverns, that often, when the fleet was in, two or three hundred marriages were contracted in a week. Persons of a more respectable character also at times resorted to the Fleet. Thus the Hon. Henry Fox was here married to Georgina Caroline, daughter of the second duke of Richmond. Pennant thus describes the neighborhood of the Fleet in his time: "In walking along the street in my youth, on the side next the prison, I have often been tempted by the question: 'Sir, will you be pleased to walk in and be married?' Along this most lawless space was hung up the frequent sign of a male and female hand conjoined, with 'marriages performed within' written beneath. A dirty fellow invited you in. The parson was seen walking before his shop, a squalid, dirty figure, clad in a tattered plaid night-gown, with a fiery face, and ready to couple you for a dram of gin or a pipe of tobacco."—*London*, p. 193. Registers of these marriages were kept by the various parties who officiated. A collection of these books, purchased by government in 1821, and deposited in the consistory court of London, amounted to the incredible number of between 200 and 300 large registers, and upwards of 1,000 smaller books, called pocket-books. These registers were not received as evidence in a court of law (*Doe* d. *Davies* v. *Gatacre*, 8 Carr. and P. 578), not because the marriage was invalid, but because the parties engaged in the ceremony were so worthless that they were deemed undeserving of credit. Various attempts were made to stop this practice by acts of parliament. By 6 and 7 Will. III. c. 52, and again by 7 and 8 Will. III. c. 35, penalties were imposed on clergymen celebrating any marriage without banns; but these provisions were without effect upon men who had nothing to lose. At length, the nuisance became intolerable, for, owing to the difficulty of proving these marriages, respectable parties who in folly had entered into them,

found it often impossible to establish their marriage, and the greatest confusion was in consequence produced. The act of the 26th Geo. II. c. 33, was therefore passed, which struck at the root of the matter by declaring that all marriages, except in Scotland, solemnized otherwise than in a church or public chapel, where banns have been published, unless by special licence, should be utterly void. This act met with strenuous opposition in the house of commons, especially by Mr. Fox, who had been himself married in the Fleet, but ultimately it was passed into a law. The public, however, were unwilling to surrender their privileges, and on the 26th Mar., 1754, the day before the act came into operation, there were no less than 217 marriages entered in one register alone. See Burn's *History of Fleet Marriages*, to which we are indebted for many of the above particulars.

FLEET PRISON, a celebrated London jail, which stood on the e. side of Farringdon street, on what was formerly called Fleet market. The keeper of it was called the warden of the Fleet. It derived its name from the Fleet rivulet, so named from its rapidity, which flowed into the Thames. By the act 5 and 6 Victoria, the F. P. and the marshalsea were abolished, and their functions transferred to the queen's bench, under the new name of the queen's prison. The Fleet was the king's prison so far back as the 12th c., and a receptacle for debtors since about the same period. The followers of Wat Tyler burned it in the reign of Richard II. In the 16th and 17th centuries, it acquired a high historical interest from its having been the prison of the religious martyrs of the reigns of Mary and Elizabeth, and of the political victims of the courts of the star chamber and high commission in that of Charles I. On the abolition of the star chamber in 1641, it became a place of confinement for debtors and persons committed for contempt from the courts of chancery, exchequer, and common pleas. During the 18th c., it was the scene of every kind of atrocity and brutality, from the extortion of the keepers and the custom of the warden underletting it. The Fleet was several times rebuilt; the last building was erected after the burning of the older one in the Gordon riots of 1780, the predecessor of which had been destroyed in the great fire of London in 1666. Latterly, it usually contained 250 prisoners, and kept ward of about 60 outdoor *detenus* for debt, privileged to live within the rules.

FLEETWOOD, Charles, b. 1620; son-in-law of Cromwell and lord-lieutenant of Ireland under the commonwealth. In the parliamentary forces he rose to the rank of col.; at the battle of Dunbar he was lieut.gen. of horse, and at the battle of Worcester the division commanded by him contributed greatly to the victory. His second wife was Bridget Cromwell, the widow of Ireton. After Cromwell's death, F. attempted to supplant his son, Richard, but before his plans were put in action the Stuarts were recalled. He died in poverty and neglect.

FLEETWOOD, or Fleetwood-on-Wyre, a small but thriving t., seaport, and military station of England, in the co. of Lancashire, is situated on a promontory at the mouth of the estuary of the Wyre, about 20 m. s.w. from Lancaster. It is a modern town, and owes its origin and importance to its facilities for railway and steam-vessel communication. It is handsomely laid out, has an excellent harbor, and is a favorite resort for sea-bathing. There was formerly a government school of musketry, which promised to be for the n. of England what Hythe and Aldershott are for the s., but it is now discontinued. It had a staff of instructors, and quarters for 300 men and 60 officers; besides a substantial hut-encampment, about a mile from the town, for 200 men and 14 officers, where there were quarters for married soldiers, hospital, lecture-rooms, etc., and a large tract of land for rifle practice. In 1877, 639 vessels, of 239,343 tons entered; and 574, of 231,200 tons, cleared the port. Pop. '71, 4,428.

FLEMING, a co. in n.e. Kentucky, on Licking river, intersected by the Maysville and Lexington railroad; 400 sq.m.; pop. '70, 13,398—1556 colored. The surface is undulating and to a large extent covered with forests; soil fertile, producing cereals, tobacco, etc. Near the Licking there is a singular deposit of fulgurites of iron ore, tubular or conical masses of ore melted and condensed by lightning striking into the earth where the ore lies. Co. seat, Flemingburg.

FLEMING, John, 1785–1857; a Scotch naturalist. He was licensed as a minister, and accepted a living in Shetland, where he became interested in natural science and wrote the *Economical Mineralogy of the Zetland and Orkney Islands*. He contributed many valuable articles to the scientific magazines and encyclopædias. His first important separate work was the *Philosophy of Zoology*, in which he promulgated a system of classification differing from those of Cuvier and Linnæus, and known as the binary system, in which animals were classed according to their positive and negative characteristics. In *History of British Animals*, he made the first attempt in Great Britain to show the paleontological history of animals with the history of animals of the present time. In 1832, he was professor of natural philosophy in Aberdeen; afterwards professor of natural science in Edinburgh. Among his works are *Molluscous Animals, including Shell Fish; The Temperature of the Seasons;* and *The Lithology of Edinburgh*.

FLEMISH LANGUAGE AND LITERATURE. The Vlaemisch or Flemish is a form of Low German still spoken in the Belgian provinces of East and West Flanders, Limburg, Antwerp, North Brabant, and in some parts of Holland and the Walloon provinces of

Belgium. So little change has taken place in this dialect, that the form of speech in which the council of Liptines drew up (in 742) the creed, in which pagans were made to express their renunciation of idolatry on being converted to Christianity, requires only the alteration of a few letters to make it intelligible to a modern Fleming. Flemish has much affinity with the Frisian, and constitutes, together with modern Dutch (which was originally identical with it, and now only differs from it in a few orthographical and otherwise unessential particulars), the national tongue of the whole of the Low Countries. The most ancient record of Flemish, is a fragment of a translation in prose of the Psalms a thousand years old. In the 13th c., public deeds began to be drawn up in the vernacular, which are perfectly intelligible in the present day (as the ordinance of Henry I. of Brabant, 1229, in the *Brussels Book of Privileges*). In the same century, J. van Maerlant, the "father of Flemish poets," author of *The Historical Mirror; Wapen Martin; Rymbibel;* etc., and W. van Utenhove composed numerous poems, and translated from the French and German, and very probably from the Latin. Willems and other critics believe that to the Flemish must be ascribed the honor of the original and entire poem of *Reinært Vos*, the first part of which they refer to the middle of the 12th c., while the second part is attributed to W. van Utenhove, and supposed to have been written about 1250. The 14th c. was remarkable for the numbers and excellence of the Flemish *Sprekkers, Zeggers*, and *Vinders*, or wandering poets, some of whose works have been published by Blommaert; and for the origin of the chambers of rhetoric, which exerted a marked influence on the progress of literature during succeeding ages, and became the arbiters of literary and dramatic fame through the Netherlands generally. In the 16th c., the French element gained ascendency, and the old Flemish lost much of its original terseness and purity. Numerous translations of the Scriptures appeared; among the most remarkable of which are the Psalms by Dathenus (1566), and by Marnix (1580), the author of the *Roomische Biekorf* (1569). The translation of the entire Bible was not effected till 1618, when the general synod of Dort decided to employ learned men capable of giving a correct version from the Hebrew and Greek texts; and this great work was finally completed by two Flemings, Baudaert and Walons, and two Dutchmen, Bogermann and Hommius. Strenuous efforts were also made, at this period, to give greater freedom to the Flemish language; and hence this original Flemish version of the Bible has become a standard in regard to the construction and orthography of the language. Hooft, Vondel, and Cats are the three men whose names stand foremost among the Flemish writers of the 17th century. Hooft was a poet, but he is best known by his *History of the Netherlands*, which is held in high esteem by his countrymen. Vondel, who was one of the leading men of his day, made his tragedies the vehicles of hurling the most cutting satire on every obnoxious measure of the government; and his works still maintain their ground. He had great versatility of powers; and in his latter years, his talents were directed to the exaltation of Catholicism, to which he had been converted. Cats was essentially the poet of the people; and for 200 years, his works, popularly known as the *Household Bible*, have been cherished alike among the poor and wealthy. Although Cats was a skillful lawyer, an active statesman, and a profound scholar, he found time to compose a great number of works, as the *Zorgvliet; Trouwring* (the Wedding Ring); *Houwelwyck* (Marriage), which exhibit the most intimate acquaintance with the everyday life of his countrymen. His work entitled *Moral Emblems* was translated into English in 1859, and published by Messrs. Longman & Co. The 18th c. was barren of poetic genius in the Low Countries, but it produced several good philologists, as Stevens, Huydecoper, and Ten Kate, the latter of whom is the author of a work on the Flemish language, which has served as a fundamental authority for modern writers. The arbitrary measures of the French government, under Napoleon, against the official use of Flemish had the effect of crushing for a time the very spirit of nationalism, while it completely annihilated native literature; and it was not till after the revolution of 1830, that the Flemish language regained its footing in the Belgian provinces. This revival of the national form of speech is mainly due to the unremitting efforts of such writers as Willems, Bilderdijk, Cornelissen, Blommaert, Conscience, Delecourt, Ledeganck, etc., whose works have imparted fresh vigor, and greater grammatical precision to the Flemish. In 1841, on the occasion of a linguistic congress held at Ghent, the members of the government for the first time publicly recognized the existence of the Flemish element in the people, and addressed the meeting in the national dialect. The last 30 years have confirmed this movement; and while the best foreign works have been rendered into Flemish, the writings of Blommaert, Conscience (q.v.), and other native authors have been translated into many of the European tongues. See Sleecx on the *History of the Flemish, and its Relation to other Languages;* Willems (1819–24), *Verhandl. ov. d. Nederduyt.;* O. Delepierre, *History of Flemish Literature* (1860).

FLEMISH SCHOOL OF PAINTING, established in the 15th c. by the brothers Van Eyck. It comprises many distinguished names. Among the early masters of this school were the Van Eycks, Memling, Weyden, Matsys, Mabus, and Moro. Later, we find Rubens, Vandyck, Snyder, Jordaens, Gaspar de Crayer, and the younger Teniers. In the beginning of this school, its characteristics were dignity and strength, and it developed the mechanical advantage (under Hubert van Eyck) of improved methods of

mixing pigments and varnishing. Later, it presented a physical energy almost coarse, a daring execution, and a brilliant color: still later, elegance, with power in historic and dramatic depiction. See PAINTING, *ante.*

FLEMMING, PAUL, one of the best German poets of the 17th c., was b. Oct. 15, 1609, at Hartenstein, in the principality of Schönburg, where his father was minister. He studied medicine at Leipsic, but was induced by the distractions of the thirty years' war to retire to Holstein in 1633. In the same year he accompanied the embassy sent by the duke of Holstein to Russia, and in 1635 was attached to the more splendid embassy sent out to Persia. He returned in 1639, married, and resolved to settle as a physician in Hamburg, but died there 2d April, 1640. F. stands at the head of the German lyric poets of the 17th century. His *Geistliche und weltliche Poemata* (Jena, 1642) contain many exquisite love songs, which, for more than a century, remained unequaled in finish and sweetness. Others are distinguished for enthusiasm of feeling, ardent patriotism, and manly vigor, while his sonnets are marked by strength and thorough originality. F.'s longer poems describe the adventures of his journey; occasionally at least with great spirit, though they are not free from the weaknesses of his time. His beautiful hymn, *In allen meinen Thaten*, composed before his journey to Persia, proves his genius as a writer of sacred songs. His life, with his select poems, was published by Schwab (Stuttgart, 1820). Compare Knapp, *Evangelischer Liederschatz* (Stuttg. 1837), and Müller in the *Bibliothek Deutscher Dichter des 17 Jahrhundert* (3 vols., Leipsic, 1822); and Varnhagen von Ense, in the 4th vol. of the *Biographische Denkmale.*

FLENS'BORG, an important t. in the province of Schleswig-Holstein (now Prussian; see SLESVIG), at the extremity of the F. Föhrde, an inlet of the Baltic, and 19 m. n. of the town of Slesvig. Pop. '75, 26,525. It is the capital of a bailiwick of the same name, which included the n. part of the district supposed to have been the country of the Angels, or Angli. F. is said to have been founded in the 12th c., and named from its founder the knight Flenes. In 1284, it received municipal rights from king Valdemar. F. is pleasantly situated, and has a good harbor, breweries and distilleries, iron and brass foundries, oil mills and brickworks, manufactures paper and glass, and has a great yard for building iron ships. The fisheries are productive, and the trade in grain and timber, etc., is brisk.

FLERS, a t. of France, in the department of Orne, n. of France, 35 m. w.n.w. of Alençon. It has an old castle, which was burned down in the Chouan war, but since restored. F. has considerable manufactures of linen, fustian, and especially of ticking. Pop. '76, 8,571.

FLESH is the ordinary term for muscular tissue. After the removal of the blood-vessels, nerves, connective (or cellular) tissue, etc., the F. is found to consist of various textural elements, which are described in the article muscle (q.v.). Numerous analyses have been made of the muscular substance of various animals. In Dr. Day's translation of Simon's *Animal Chemistry*, published by the Sydenham society, there are analyses of the F. of man, the ox, calf, pig, roe, pigeon, fowl, carp, and trout. The following table gives the determinations of the individual constituents of the F. of oxen, or, in ordinary language, of beef freed, as far as possible, from blood-vessels, etc., and may be regarded as fairly representing the composition of flesh generally:

		Per cent.		Per cent.
Water	varies from	74.0	to	80.0
Solid constituents	vary "	26.0	"	20.0
		100.0		100.0
The latter being made up of				
Muscular fiber which	varies from	15.40	"	17.70
Gelatigenous substance	" "	0.60	"	1.90
Albumen	" "	2.20	"	3.00
Creatine	" "	0.07	"	0.14
Creatinine		undetermined.		
Inosic acid		do.		
Fat	" "	1.50	to	2.30
Lactic acid ($C_6H_5O_5,HO$)	" "	0.60	"	0.68
Phosphoric acid	" "	0.66	"	0.70
Potash	" "	0.50	"	0.54
Soda	" "	0.07	"	0.09
Chloride of sodium	" "	0.04	"	0.09
Lime	" "	0.02	"	0.03
Magnesia	" "	0.04	"	0.08

Long as the above list of substances is, it does not include all the ingredients of flesh. In the freshly expressed muscular juice, which exhibits a strong acid reaction (from free lactic acid, and from acid phosphates of the alkalies), we also find small quantities of sarcine or hypoxanthine (q.v.), and of formic, butyric, and acetic acids—which may, however, be mere products of decomposition; very minute quantities of uric acid, and sometimes a trace of urea, which, however, occurs in very appreciable quantity in the

muscles of persons who have died of cholera, and in very considerable quantity in the F. of the plagiostomous fishes, while in other fishes not a trace of it can be detected—an apparent anomaly to which at present we see no clew; and in the juice of the heart of mammals, and in smaller quantity in their other muscles, a kind of sugar termed inosite (q.v.). Bernard has recently discovered glycogen (q.v.) in the muscles of the embryos of various animals.

In regard to the inorganic constituents of the juice of F., Liebig directs especial attention to the fact, that this fluid "in all animals is particularly rich in potash, and that it also contains chloride of potassium, with only traces of chloride of sodium; while in the blood only proportionally small quantities of the salts of potash, and preponderating quantities of the salts of soda and of common salt, are present." He further notices the constant excess of the phosphates over the chlorides, and of the phosphate of lime over that of magnesia in the former fluid, as points of physiological importance. The value of these investigations will be shown in the article TISSUES (q.v.).

It is worthy of notice, in connection both with physiology and dietetics, that the dried F. of the ox is identical in its ultimate composition with dried blood, as is shown by the following analyses, which were made by prof. Lyon Playfair:

	Beef.	Ox-blood.
Carbon	51.83	51.95
Hydrogen	7.57	7.17
Nitrogen	15.01	15.07
Oxygen	21.37	21.39
Ashes	4.23	4.42

This analysis singularly confirms the statement made previously by an eminent French physiologist, that in so far as ultimate organic composition is concerned, "the blood is liquid flesh."—For further information on the subject, we may refer to Liebig's *Researches on the Chemistry of Food*, translated by Gregory, and Lehmann's *Physiological Chemistry*, vol. iii.

FLESH-FLY, or BLUE-BOTTLE-FLY (*musca vomitoria*), an insect of the same genus with the common house-fly (q.v.), which it much exceeds in size, although it is not equal in size to the blow-fly (q.v.). The forehead is rust-colored, the thorax grayish, the abdomen blue with three black bands. The expanse of wings is nearly 1 inch. It is abundant throughout Britain and Europe generally, and deposits its eggs on flesh, for which purpose it often enters houses, having a remarkably delicate sense of smelling. The maggots are of very frequent occurrence on meat in summer, notwithstanding all care that can be taken.—A nearly-allied species (*M. Cæsar*) is distinguished by its golden green color, and is also common in Britain. It is found in houses from the beginning of spring to the end of autumn. Another (*M. lardaria*), with silky tawny face, a black stripe on the crown, thorax glittering white with four black stripes, and abdomen bluish-gray, tesselated with black, is most common in the end of autumn, frequenting bushes of ivy and late flowers, and is also a pest of the larder.

FLE'TA, the title of a valuable treatise on the law of England. It is not known by whom this treatise, which is one of the earliest authorities on English law, was written, and it derives its title from the circumstance that it was written in the Fleet prison. Lord Campbell remarks (*Lives of the Chancellors*, i. 166 and note): "I shall rejoice if I do tardy justice to the memory of Robert Burnel, decidedly the first in this class, and if I attract notice to his successors, who walked in his footsteps. To them, too, we are probably indebted for the treatises entitled *Fleta* and *Britton*, which are said to have been written at the request of the king, and which, though inferior in style and arrangement to Bracton, are wonderful performances for such an age. *Fleta* must have been written after the 13th year of the king (Edward I.), and not much later: for it frequently quotes the statute of Westminster the second, without referring to the later statutes of the reign.

FLETCHER, ANDREW, of Saltoun, a celebrated Scottish patriot and politician, was the son of sir Robert F. and Catherine Bruce, daughter of sir Henry Bruce of Clackmannan. He was b. in 1653. Notwithstanding the strong anti-English feelings which characterized him through life, F. was of English descent by the father's side; his father being the fifth in the direct line from sir Bernard F. of the co. of York. But his mother was of the royal house of Scotland, the first of the Clackmannan family having been the third son of the lord of Annandale, Robert de Bruce, who was the grandfather of the great king Robert. F.'s father, who died in his childhood, consigned him to the care of Gilbert Burnet, then minister of Saltoun, afterwards the well-known bishop of Salisbury; by whom he was instructed not only in literature and religion, but in those principles of free government of which he afterwards became so zealous an advocate. So early as 1681, when he sat in parliament for the first time as commissioner for East Lothian, F. offered so determined an opposition to the measures of the duke of York (afterwards James II.), then acting as the royal commissioner in Scotland, that he found it necessary to retire, first into England, and then into Holland. He there entered into close alliance with the English refugees, who had assembled in considerable numbers; and on his return to England in 1683, he shared the counsels of the party of which Rus-

sell, Essex, Howard, Algernon Sydney, and John Hampden (the grandson of the still more famous patriot of the same name) were the leaders. Though usually regarded as a republican, F.'s political creed, like that of Algernon Sydney, approached far nearer to aristocracy than to democracy in the modern sense; for though he was disposed to restrict the monarchical element of the constitution within the narrowest limits, if not to abolish it altogether, he was so far from being an advocate for a universal participation in political rights, that one of his favorite schemes for the reformation of the hosts of vagrants and paupers by whom Scotland was infested in his day, consisted in the establishment of slavery in the form in which it had existed in the classical nations of antiquity. On the discovery of the Rye house plot, F. returned to Holland. His next visit to England was as a volunteer under the unfortunate duke of Monmouth in 1685; but he was compelled to leave the insurgent army, at the beginning of the enterprise, in consequence of his having shot the mayor of Lynn, with whom he had had a personal quarrel about a horse. The next hiding-place which F. selected was Spain; but he had no sooner arrived, than he was thrown into prison at the instance of the English ambassador, and would have been transmitted to England, to share the fate of his fellow-patriots, had he not been mysteriously delivered from prison by an unknown friend. From Spain he proceeded to Hungary, where he entered the army as a volunteer, and greatly distinguished himself. He returned to England at the revolution. A few years later, he met in London, accidentally, it should seem, the famous William Paterson, the founder of the bank of England, and the projector of the Darien expedition in London; and it was at F.'s solicitation that Paterson came to Scotland, and offered to the acceptance of his countrymen, a project which he had originally intended should be carried out by the far greater resources either of the trading communities of the Hanse towns, or of the princes of the German empire. The bitterness caused by the treatment which the Darien colonists received at the hands of king William's government, tended to confirm F. and his friends in their opposition to the union with England, and led to his delivering in parliament those spirited harangues in favor of an exclusive Scottish nationality, which still stir the blood of his countrymen. After the union, he retired in disgust from public life, and died in London in 1716. F.'s writings originally appeared in the form of tracts, and anonymously; they were, however, collected and reprinted at London in 1737, under the title of *The Political Works of Andrew Fletcher, Esquire.*

FLETCHER, BENJAMIN, colonial governor of New York from 1692 to 1698. He was persistent in endeavoring to establish the English in place of the Dutch reformed church, but was unsuccessful. Under William and Mary, he was commissioned as governor of Pennsylvania.

FLETCHER, GILES and PHINEAS, were the sons of Dr. Giles Fletcher, queen Elizabeth's ambassador to the court of Russia, and cousins to Fletcher the dramatist.

GILES, the elder, was b. about 1580; he was educated at Cambridge, and d. at his living at Alderton in 1623. His chief poetical work is a sacred poem, entitled *Christ's Victory and Triumph*, which appeared at Cambridge in 1610. This poem, although once admired, is now unknown to general readers, and is chiefly remarkable for having, to some extent, molded the majestic muse of Milton.

PHINEAS, the younger brother of Giles, was b. about 1584, educated at Eton and Cambridge, and became rector of Hilgay, in Norfolk, in 1621, and died there in 1660. His most important poem, the *Purple Island, or the Isle of Man*, was published in 1633. It contains an elaborate description of the human body and mind—the former being given with great anatomical minuteness. The mind is represented as being beleaguered with the vices, and likely to be subdued, when an angel comes to the rescue—the angel being James I. Although to a large extent formal and pedantic, the *Purple Island* abounds in fine passages, in which the lusciousness of Spenser and the gravity of Milton are curiously mingled.

FLETCHER, JAMES COOLEY, b. Ind., 1823; graduated at Brown university, and studied theology at Princeton, and in Paris and Geneva. In 1851, he was in Rio Janeiro, as chaplain or missionary of the American and foreign Christian union, also as the American secretary of legation. At a later period, he traveled extensively in Brazil, and embodied his observations in *Brazil and the Brazilians*. In 1869, he was sent as consul to Oporto.

FLETCHER, JOHN. See BEAUMONT AND FLETCHER.

FLETCHER, JOHN WILLIAM (FLÉCHIÈRE, JEAN GUILLAUME DE LA), 1729–85; b. Switzerland, educated at Geneva. He intended to be a clergyman, but so disliked extreme Calvinistic doctrines that he abandoned that purpose and went into the military service of Portugal, but afterwards took a commission in the Dutch army. Peace intervened before he had opportunity to fight, and he went to England, where he became a tutor. In 1755, he joined the Methodist society, and two years later he took orders in the church of England, and, refusing a rich parish, became vicar of Madeley, laboring with much self-sacrifice among the most debased and neglected people. For a time, he labored under the auspices of the countess of Huntington, but his Arminian views severed him from that Calvinistic connection. He was one of the founders of Method-

ism, working for many years with Wesley, Whitefield, and their compeers. His works have been published in New York.

FLEUR-DE-LIS. Authorities are divided as to whether this celebrated emblem is derived from the white lily of the garden, or from the flag or iris, which, as generally represented, it more resembles both in form and color. "Ancient heralds," says Newton (*Display*, p. 145), "tell us that the Franks of old had a custom, at the proclamation of their king, to elevate him upon a shield or target, and place in his hand a reed or flag in blossom, instead of a scepter; and from thence the kings of the first and second race in France are represented with scepters in their hands like the flag with its flower, and which flowers became the armorial figures of France." However this may be, or whatever may be the value of the other legendary tales, such as that a blue banner, embroidered with golden fleurs-de-lis, came down from heaven; that an angel gave it to king Clovis at his baptism, and the like; there can be little doubt that, from Clovis downwards, the kings of France bore as their arms first an indefinite number, and latterly three golden lilies on a blue field, or, as heralds would say, azure, three fleurs-de-lis, Or. It was Charles VI. who reduced what had hitherto been the indefinite number of fleurs-de-lis to three, disposed two and one; "some conjecture upon account of the Trinity, others say, to represent the three different races of the kings of France."—Nisbet, i. 383. Many English and Scotch families bear the fleur-de-lis in some portion of their shield, and generally with some reference to France.

FLEUR-DE-LIS. See Iris.

FLEURUS, a small t. of Belgium, in the province of Hainault, is situated n. of the left bank of the Sambre, and 15 m. w. of Namur: pop. about 2,200. It has been the scene of several contests, the last and most important, however, being the battle of F., fought here 26th June, 1794, between the army of the French republic, consisting of 89,000 troops, under Jourdan, and the allies, who were inferior in numerical strength, under the prince of Saxe-Coburg. The latter leader gave orders for a retreat at the very moment when a resolute advance might have decided the victory in his favor, and the result was that Jourdan was enabled to unite his army with those of the Moselle, the Ardennes, and the north, and that the allied forces were compelled for a time to evacuate Flanders.

FLEURY, André Hercule de, Cardinal, the celebrated minister of Louis XV. of France. He was educated at the Jesuit college in Paris, appointed almoner to the queen Maria Theresa, and by Louis XIV. made bishop of Frejus in 1698. When Louis XIV. died, the regent appointed him preceptor to Louis XV., then but five years old. On the death of the regent he took a seat in the privy council. In 1726, when he was in his 73d year, he assumed supreme power, and was created cardinal. Under his administration, France in her internal affairs was prosperous, but fell into difficulties in relations with foreign countries.

FLEURY, Claude, a French church historian, was b. at Paris, 6th Dec., 1640, and was educated at first for the law, but preferring an ecclesiastical career, subsequently took priest's orders. In 1672, he became tutor to the young prince de Conti, who was brought up along with the dauphin, and at a later period, to the comte de Vermandois, natural son of Louis XIV. After the death of the comte in 1683, the French monarch appointed him, under Fenelon, tutor to the princes of Burgundy, Anjou, and Berri, and also abbot of the Cistercian monastery of Loc-Dieu. When the princes had completed their education, F. was rewarded with the priorate of Argenteuil. The duke of Orleans selected him for confessor to the young king, Louis XV., giving as his reason for so doing, that F. was neither Jansenist, nor Molinist, nor Ultramontanist, but Catholic. F. held this office till 1722, when the infirmities of age compelled him to resign it. He died 14th July, 1723. F. was as learned as he was modest, and as mild and kind-hearted as he was simple in his manners and upright in his conduct. Among his numerous works may be mentioned, *Mœurs des Israélites* (Paris, 1681); *Mœurs des Chrétiens* (Paris, 1682); *Traité du Choix et de la Méthode des Études* (Paris, 1686); *Institution au Droit Ecclésiastique* (1687); and, above all, the *Histoire Ecclésiastique* (20 vols., Paris, 1691–1720). On this work, F. labored 30 years. It is marked by great learning, and, on the whole, by a judiciously critical spirit. What may be called his professional sympathies are held in check by a noble desire to be impartial, which might well put to the blush the unveracious partisanship of many Protestant writers. Semler (q.v.), an eminent German theological professor, avowed that his lectures were at first mainly extracts from the *Histoire Ecclésiastique*. Even Voltaire praised it. "The history of F.," says he, "is the best that has ever been executed." D'Alembert and many others recommend F.'s style as a model of elegant simplicity. The so-called *Abrégé de l'histoire Ecclésiastique de Fleury*, published at Berne in 1776, is ascribed to Frederick the great. A posthumous work of F.'s, entitled *Discours sur les libertés de l'Eglise Gallicane*, has always been very popular.

FLEURY, Flory, Flowry, Fleurette, etc., in heraldry, signifies that the object is adorned with fleurs-de-lis; a cross-fleury, for example, is a cross, the ends of which are in the form of fleurs-de-lis. There are several varieties in the modes of representing these crosses, which has led to distinctions being made between them by heralds too

trivial to be mentioned: but they are all distinguishable from the cross-potance, or potancée, incorrectly spelled patonce by English herald (Mackenzie's *Science of Heraldry*, p. 44). In the latter, the limbs are in the form of the segments of a circle, and the foliation is a mere bud; whereas the cross-fleury has the limbs straight and the terminations distinctly floriated.

Perhaps the most celebrated instance of this bearing is in the case of the double prepuce flowery and counter-flowery gules which surrounds the red lion in the royal arms of Scotland, and which Charlemagne is said to have conferred on Achius, king of Scotland, for assistance in his wars. The object, according to Nisbet (ii. 101), was to show that, as the lion had defended the lilies of France, these "hereafter shall continue a defense for the Scots lion, and as a badge of friendship, which has still continued." That the lilies were assumed in consequence of the intimate relation which prevailed between France and Scotland for so many generations, will not be doubted; but the special occasion of the assumption may not be admitted in our day to be quite beyond the reach of skepticism, notwithstanding Nisbet's assertion that it is so fully instructed by ancient and modern writers that he need not trouble his readers with a long catalogue of them.

FLEURY, Louis de, Chevalier and viscount of France, who joined the patriot army during the American war of the revolution, was appointed to a captaincy by Washington, rose to be lieut.col., and commanded a battalion of light infantry. 'He fought under Steuben and Lee, and having greatly distinguished himself by personal gallantry at the storming of Stony Point, he received a silver medal and the thanks of congress. After the war he returned to France in the service of count Rochambeau.

FLEXIBLE SANDSTONE, or Itacolumite, a metamorphic siliceous rock of Brazil and the Alleghany region of the United States, occurring in thin and somewhat flexible (but non-elastic) layers. These layers may be bent back and forth many times without breaking.

FLEX'URE, or Flexion, is the bending or curving of a line or figure (see Curvature). A curve is said to have a point of *contrary* flexure at the point where it changes its character of concavity or convexity towards a given line. In the art of building, flexure denotes the bending of loaded beams. If a beam, supported at its two ends, be loaded, it bends, its lower surface becoming convex, and its upper concave. In this bending, the particles in the lower surface are drawn away from each other, and those in the upper are more closely packed together, while between the surfaces there is a line called *the line of no disturbance*, wherein the particles are neither drawn asunder nor compressed, and from which the mathematical theory of the flexure of beams starts. Experiments show that the flexure of solid beams, supported at their ends, and loaded, varies—(1.) directly as the load; (2.) inversely as the product of their *breadths*, and the cube of their *depths;* and (3.) directly as the cube of the distance between the supports, while the flexure, if the load be uniformly distributed over the beam, is five eighths of the amount produced by the load placed on its center. See Strength of Materials.

FLIEDNER, Theodor, d.d., 1800–64; a Christian philanthropist; b. at Eppstein, a village on the frontiers of Hesse and Nassau, where his father was pastor of the parish church. He studied at the universities of Giessin and Göttingen, and the theological seminary of Herborn; was licensed to preach at the age of 20, and the next year became pastor of the small church at Kaiserswerth, a town on the Rhine below Düsseldorf. His salary was to be 180 Prussian dollars, but even this the congregation (through the failure of the factory in which many of them were employed) soon became unable to pay. This induced him to undertake a tour to raise funds in their behalf. "Never did a man begin to ask for help with a heavier heart, nor with worse success, till a brother pastor at Elberfeldt took him home to dinner and told him that the three requisites for his work were patience, impudence, and a ready tongue. The recipe, to which F. added much prayer and faith, proved so successful that he became the most accomplished beggar known in Germany. England, America, and many distant regions learned to pour their contributions into his wallet, and often his worst necessities were relieved by what seemed almost miraculous, unsolicited gifts, which exactly answered the demands made on him." During a visit to England in 1823, he became acquainted with the benevolent work of Elizabeth Fry. Having returned home, he visited the prisons around him, and found them in a dreadful condition. The convicts were crowded together in narrow, dirty cells, and dark, damp, and close cellars; boys were mixed up with cunning old sinners, and young girls with corrupt women. There was no classification whatever; persons committed for trial, who might be proved innocent, and be discharged, were placed with criminals condemned to a long imprisonment. There was no supervision except to prevent escape. For more than two years F. tried by his personal toil alone to remedy these evils; afterwards he formed the first German society for improving prison discipline. When seeking a matron for the women's wards at Düsseldorf he found his wife, whose parents refused to let her take that position alone, but approved her acceptance of the young pastor himself, although the second offer included all the duties of the first. In 1833, he took into a summer-house in his garden a poor discharged prisoner who wished to reform, and this act proved the beginning of his work for the reformation of convicts. A friend of his wife, coming

to take charge of this small beginning, was styled a deaconess. Soon the summer-house was replaced by a larger building, the solitary deaconess obtained companions, and the establishment continued to grow. This suggested the order of deaconesses for the care of the sick poor. He bought a house without money to pay for it, but with great faith. All his enterprises began in this small way. His hospital was started with one table, some broken chairs, a few worn knives and two-pronged forks, seven sheets, and four severe cases of illness. The institution soon flourished under royal favor. In 1838, he first sent deaconesses to work in other places, and from this beginning "mother-houses" multiplied until, in 1866, there were 139. In the course of his life F. established at Kaiserswerth training colleges for school-mistresses and governesses, a lunatic asylum, a boys' school, and a training college for school-masters. All these institutions are turned to account in the training of deaconesses. Many curious incidents are related to show his personal interest in his work. In his infant schools he would throw himself down on the floor to illustrate the killing of Goliath; he distributed bread and honey to show the excellence of heavenly manna, and sent boys under the table to enliven the story of travelers falling down a precipice. His toil continued until, physically worn out, he died. To the last, he took eager interest in the details of work, persevered in earnest exhortations, and closed his life by receiving the communion with his whole establishment and family, including two sons whose reception into the church he had earnestly desired.

FLIES, Spanish or Blistering. See Cantharis.

FLINCK, Govert, 1615–60; a Dutch painter, a pupil of Rembrandt, and a follower of that master's style. His first subject-picture is the "Blessing of Jacob," in the Amsterdam museum, his earliest production being a likeness of a lady, in the gallery at Brunswick. Both are thoroughly Rembrandtesque, in effect as well as in vigor of touch and warmth of flesh-tints. The four "Civic Guards" and "Twelve Musketeers," with their president in an arm-chair, in the town-hall at Amsterdam, are fine specimens of composed portrait groups. But the best of Flinck's productions in this style is the "Peace of Munster," in the museum of Amsterdam, a canvas with 19 life-size figures full of animation in the faces, "radiant with Rembrandtesque color," and admirably distributed. Flinck here painted his own likeness to the left in a door-way. The mannered period of Flinck is amply illustrated in the "Marcus Curius eating Turnips before the Samnite Envoys," and "Solomon receiving Wisdom," in the palace on the dam at Amsterdam.

FLINDERS, Matthew, an adventurous English navigator, to whom we are indebted for a correct knowledge of a great portion of the Australian coast, was b. at Donington, in Lincolnshire, 1760. He entered the merchant service at an early age, and subsequently the royal navy. In 1975, the vessel in which he was midshipman conveyed the governor of New Holland to Botany bay; and while there, F. determined to investigate the coast s. of Port Jackson, about 250 leagues of which were laid down in the charts as "unknown." With an equally daring and ambitious young surgeon in his ship, called Bass, he departed on the enterprise in a small decked vessel, with a crew of only six men. Their chief discovery was the straits between Van Diemen's Land (now Tasmania) and the mainland of Australia, which were named after Bass. In 1801, F. obtained from the British government the command of a scientific expedition for the investigation of the Australian coasts and their products. Commencing his examination at cape Leuwin, F., in the course of two years, gradually explored the coast to Bass's straits, thence northwards—laying down carefully the great barrier reefs—to the gulf of Carpentaria, which he thoroughly surveyed across to Timur, then back to cape Leuwin, and round the s. coast to Port Jackson. In 1810, he was liberated from a six years' imprisonment by the French in the isle of France, returned to England, and gave the world the result of his researches in a work, entitled *A Voyage to Terra Australia.* He died July 19, 1814, the day on which his book was published.

FLINDERSIA, a genus of trees of the natural order *cedrelaceæ*, one species of which, *F. australis*, yields timber little inferior to mahogany. It is much used in Australia, and is there called callcedra wood.

FLINDERS LAND, now South Australia (q.v.).

FLINT, a mineral which may be regarded as a variety of quartz, or as intermediate between quartz and opal, consisting almost entirely of silica, with a very little lime, oxide of iron, water, carbon, and sometimes even traces of organic matter. It has a flat shell-like fracture, is translucent or semi-transparent, and varies in color from a very dark brown, or almost black, to light brown, red, yellow, and grayish white, and is sometimes veined, clouded, marbled, or spotted. Dark-colored Flints are most common in the chalk, in which principally F. occurs imbedded, forming nodules of various sizes, sometimes large nodular masses, of irregular and often grotesque shape; but gravel formed of light-colored flints is very common, and it is disputed whether or not a change of color has taken place by exposure to atmospheric and other chemical agencies. F. is sometimes found in beds or veins. It is very abundant wherever the chalk formation extends, in England and other countries; rolled F. nodules are also often found in compound rocks, and in alluvial soils; vast alluvial tracts being sometimes full of them. F.

geodes often contain crystals of quartz. F. nodules are usually moist in the interior if broken when newly taken from their beds.

F. is sometimes harder than quartz, sufficiently so to scratch it. The readiness with which is strikes fire with steel is well known, and it would seem that the sparks are not all merely incandescent particles, heated by the friction, but that in some of them a chemical combination of silica and iron takes place, causing great increase of heat. The use of the F. and steel for igniting tinder, once so common, has been almost superseded by that of lucifer matches, and gun flints have given place to percussion caps. According to Pliny, Clias was the first who struck fire with F.; or more probably, he was the first to show its application to useful purposes; and he therefore received the name *Pyrodes*. The most ancient use of F. was probably for sharp weapons and cutting instruments; and F. knives, axes, arrow-heads, etc., are among the most interesting relics of rude antiquity.

At present, a principal use of F. is in the manufacture of fine earthenware, into the composition of which it enters, being for this purpose first calcined, then thrown into cold water, and afterwards powdered.

The origin of F. is a subject of considerable difficulty. Siliceous deposits are sometimes a purely chemical operation, as in the case of the siliceous sinter formed round the geysers of Iceland, from the evaporation of water largely charged with silex. But at the bottom of the sea, as no evaporation could take place, some other agent than springs of water saturated with silex must have supplied the materials. It is a fact of considerable importance in this inquiry, that almost all large masses of limestone have thin siliceous concretions, or flints. Thus, chert is found in carboniferous and other limestones, and menilite in the tertiary limestones of the Paris basin. The conditions necessary for the deposition of calcareous strata seem to be those required for the formation of siliceous concretions. The materials of both exist in solution in sea-water, and as it needed the foraminifer, the coral, and the mollusk to fix the carbonate of lime which formed the chalk deposits, so the silex was secreted by innumerable diatoms and sponges, and their remains most probably supplied the material of the flint. The discovery by Dr. Bowerbank and other microscopists of the spicules of sponges and the frustules of diatoms in almost every specimen of F., has clearly shown that F. to a large extent, if not entirely, owes its origin to these minute organisms. It is, however, difficult to account for the changes that have taken place in these materials subsequent to their deposition.

FLINT, a river of Georgia, one of the United States of America, unites on its right with the Chattahoochee, at the s.w. angle of the state, to form the Appalachicola, which, after a course of 100 m., enters the gulf of Mexico. The F. itself is about 300 m. long, being practicable for steam-boats up to Albany, about 250 m. distant from the sea.

FLINT, a city and township, and seat of justice in Genesee co., Mich., on Flint river and Flint and Pere Marquette railroad, 64 m. n.n.w. of Detroit; pop. of city '70, 5,386. It has a court-house, city hall, high school, nearly a dozen churches, the state institution for the deaf and dumb, and a number of manufactories, especially of lumber. It has had rapid growth.

FLINT, a parliamentary borough and seaport in the e. of Flintshire, North Wales, formerly the capital of the co., on the left side of the estuary of the Dee, 191 m. n.w. of London by rail, and 12½ m. n.w. of Chester. It forms a rectangle like a Roman camp, and is surrounded by now nearly obliterated ramparts and intrenchments. The Dee estuary is some miles wide here, but is shallow and narrow at low water. Vessels of 300 tons reach the town. The principal exports are coal and lead from mines in the vicinity, which afford the chief employment. Pop. '71, 4,269. It unites with seven other places in sending one member to parliament. Roman relics and traces of Roman lead smelting-works have been found here. On a low freestone rock in a tidal marsh are the remains of a castle, built by Henry II., and dismantled in 1647. The double tower or keep is 40 ft. in diameter, and includes two concentric walls, each 6 ft. thick, with an intervening gallery 8 ft. broad; within, is a circle 20 ft. in diameter, with four entrances. Deterioration of the channel of the Dee has made F. in a great degree a port of Chester, and here larger vessels, especially with timber, are discharged, and the cargoes floated up the Dee in smaller vessels, the timber in rafts.

FLINT, AUSTIN, a physician; b. Mass., 1812; educated at Amherst and Harvard, graduating as M.D. at the latter in 1833. After practicing in Boston and Northampton, he removed to Buffalo, N. Y., in 1836. He was appointed professor of the institutes and practice of medicine in Rush medical college, Chicago; resigned after one year, in 1846, and established the *Buffalo Medical Journal*. With Drs. White and Hamilton he founded the Buffalo medical college in 1847, where he was professor of the principles and practice of medicine for six years. He was afterwards professor of the theory and practice of medicine in the university of Louisville, Ky., from 1852 to 1856. He was then called to the chair of pathology and clinical medicine at Buffalo. From 1858 to 1861, he was professor of clinical medicine in the school of medicine at New Orleans. In 1859, he removed to New York, and in 1861 was appointed visiting physician to Bellevue hospital, professor of the principles and practice of medicine in Bellevue hos-

pital medical college, and of pathology and practical medicine in Long Island college hospital. He is the author of several important medical essays and books, among which are works on *Continued Fever; Chronic Pleurisy; Dysentery; Physical Exploration, and Diagnosis of Diseases affecting the Respiratory Organs; A Practical Treatise on the Pathology, Diagnosis, and Treatment of Diseases of the Heart;* and a *Treatise on the Principles and Practice of Medicine.*

FLINT, AUSTIN, Jr., b. Mass., 1836; a physician, son of Austin. He attended medical lectures at the university of Louisville and afterwards at Jefferson medical college, Philadelphia, where he graduated in 1857. For the following two years he was editor of *Buffalo Medical Journal*, and surgeon to Buffalo city hospital, and professor of physiology and microscopical anatomy in the university of Buffalo. In 1859, he removed to New York with his father, and was appointed professor of physiology in New York medical college. He was appointed professor of physiology in the school of medicine at New Orleans, and went to Europe in the following spring. In 1861, he became professor of physiology and microscopic anatomy in Bellevue hospital medical college, New York, in which position he remains (1880). Dr. Flint has made extensive experimental investigations in human physiology, and has made several important discoveries. He has assisted in establishing the glycogenic function of the liver; has shown that one of the functions of the liver is to separate from the blood the cholesterine, which is a product of the nervous system, and which cholesterine, becoming a constituent of the bile, is afterwards converted into what he has named stercorine, the odorous principle of the fæces. He has also made many important observations on the functions of the nervous system. His principal works are *The Physiology of Man*, 5 vols. 8vo., and a *Treatise on Human Physiology*, 1 vol. 8vo.

FLINT, Rev. TIMOTHY, an American clergyman and author, was b., in 1780, at Reading, Mass., and graduated at Harvard college. In 1802, he became minister of the Congregational church in Lunenburg, co. of Worcester in that state, where he remained till 1814. In the following year, he became a missionary for the valley of the Mississippi, where he was engaged in itinerant preaching and teaching a school. In 1825, he returned to the northern states; and in 1826, published his *Recollections of Ten Years passed in the Valley of the Mississippi* (Boston, 8vo). The same year appeared from his pen a novel, entitled *Francis Berrian, or the Mexican Patriot*, purporting to be the autobiography of a New England adventurer who acted a conspicuous part in the first Mexican revolution, and in the overthrow of Iturbide. In 1828, he issued two works: *A Condensed Geography and History of the Western States in the Mississippi Valley* (Cincinnati, 2 vols. 8vo); and *Arthur Clenning*, a novel (Philadelphia, 2 vols. 8vo). Another novel, *George Mason, or the Backwoodsman*, and a romance in 2 vols., *The Shoshonee Valley*, appeared at Cincinnati in 1830. In 1833, he edited several numbers of the *Knickerbocker Magazine*, and was subsequently editor for three years of *The Western Monthly Magazine*. His other works are: *Indian Wars in the West* (1833, 12mo); *Lectures on Natural History, Geology, Chemistry, and the Arts* (Boston, 1833, 12mo); translation of Droy's *L'Art d'être Heureuse*, with additions by translator; and *Biographical Memoir of Daniel Boone, the first Settler of Kentucky* (Cincinnati, 1834, 18mo). In 1835, he contributed to the London *Athenæum* a series of sketches of the literature of the United States. He died at Salem, Aug. 16, 1840.—His son, MICAH P. FLINT, published a volume of poetry, entitled *The Hunter and other Poems*.

FLINT GLASS. See GLASS.

FLINT IMPLEMENTS AND WEAPONS, believed to have been used by the primitive inhabitants, have from time to time, in more or less number, been turned up by the plow and the spade, dug out from ancient graves, fortifications and dwelling-places, or fished up from the beds of lakes and rivers, in almost every country of Europe. They do not differ, in any material respect, from the flint implements and weapons still in use among uncivilized tribes in Asia, Africa, America, and the islands of the Pacific ocean. The weapons of most frequent occurrence are arrow-heads (see ELF-ARROWS), spear-points, dagger-blades, and ax-heads or Celts (q.v.). The more common implements are knives, chisels, rasps, wedges, and thin curved or semi-circular plates, to which the name of "scrapers" has been given. There is great variety, as well in the size as in the shape, even of articles of the same kind. There is equal variety in the amount of skill or labor expended in their manufacture. In some instances, the flint has been roughly fashioned into something like the required form by two or three blows; in others, it has been laboriously chipped into the wished-for shape, which is often one of no little elegance. In yet another class of cases, the flint, after being duly shaped, has been ground smooth, or has even received as high a polish as could be given by a modern lapidary. Examples of all the varieties of flint weapons and implements will be found in the British museum, in the museum of the royal Irish academy at Dublin, in the museum of the society of antiquaries of Scotland at Edinburgh, and above all, in the museum of the royal society of antiquaries at Copenhagen, which is especially rich in this class of remains. Representations of interesting or characteristic types may be seen in the *Catalogue of the Archæological Museum at Edinburgh in* 1856 (Edin. 1859); in Mr. Wilde's *Catalogue of the Antiquities in the Museum of the Royal Irish*

Academy (Dubl. 1857–61); in Worsaae's *Nordiske Oldsager i det Kongelige Museum i Kjobenhavn* (Copen. 1859); and in M. Frederic Troyon's *Habitations Lacustres* (Lausanne, 1860).

Geological discoveries have recently invested flint implements with a new interest. At Abbeville, at Amiens, at Paris, and elsewhere on the continent, flint weapons, fashioned by the hand of man, have been found along with remains of extinct species of the elephant, the rhinocerous, and other mammals, in undisturbed beds of those deposits of sand, gravel, and clay to which geologists have given the name of "the drift." They so far resemble the flint implements and weapons found on the surface of the earth, but are generally of a larger size, of ruder workmanship, and less varied in shape. They have been divided into three classes—round-pointed; and sharp-pointed, both being chipped to a sharp edge, so as to cut or pierce only at the pointed end; and oval-shaped, with a cutting edge all round. The first and second classes vary in length from about 4 in. to 8 or 9 in.; the third class is generally about 4 or 5 in. long, but examples have been found of no more than 2 in., and of as much as 8 or 9 in. In no instance has any flint implement discovered in the drift been found either polished or ground. The French antiquary, M. Boucher de Perthes, was the first to call attention to these very interesting remains, in his *Antiquités Celtiques et Antédiluviennes* (Paris, 1847–57). But it has since been remembered that implements of the same kind were found in a similar position at Hoxne, in Suffolk, along with remains of some gigantic animal, in 1797, and at Gray's Inn Lane, in London, along with remains of an elephant, in 1715. Both these English examples are still preserved—the first in the museum of the society of antiquaries at London, the second in the British museum, and they are precisely similar in every respect to the examples more recently found in France.

To what age these remains should be assigned, is a question on which geology seems scarcely yet prepared to speak with authority. But, in the words of Mr. John Evans, in his essay on "Flint Implements in the Drift," in the *Archæologia*, vol. xxxviii. (Lond. 1860), "thus much appears to be established beyond a doubt, that in a period of antiquity remote beyond any of which we have hitherto found traces, this portion of the globe was peopled by man; and that mankind has here witnessed some of those geological changes by which the so-called diluvial beds were deposited. Whether these were the result of some violent rush of waters, such as may have taken place when 'the fountains of the great deep were broken up, and the windows of heaven were opened,' or whether of a more gradual action, similar in character to some of those now in operation along the course of our brooks, streams, and rivers, may be matter of dispute. Under any circumstances, this great fact remains indisputable, that at Amiens, land which is now 160 ft. above the sea, and 90 ft. above the Somme, has, since the existence of man, been submerged under fresh water, and an aqueous deposit from 20 to 30 ft. in thickness, a portion of which, at all events, must have subsided from tranquil water, has been formed upon it; and this, too, has taken place in a country the level of which is now stationary, and the face of which has been little altered since the days when the Gauls and the Romans constructed their sepulchres in the soil overlying the drift which contains these relics of a far earlier race of men."

FLINTSHIRE, a maritime co. of n. Wales, bounded on the e. by Cheshire and the river Dee, on the s. and w. by Denbighshire, and on the n. by the Irish sea. The main portion of the county is 25 m. long by 10 broad, and the larger of the two outlying portions, which lies toward the s.e. of the main part, is 10 m. by 5. F. is the smallest of the Welsh counties, its area being only 169,162 acres, of which $\frac{4}{5}$th is arable. The coast, 20 m. long, is low and sandy, but on the Dee estuary fertile. A hill-range, parallel to the Dee, runs through the length of the county, and rises in Garreg to 825 feet. Another range along the s.w. border of the county rises in Moel Famma, 1845 feet. The chief rivers are the Dee, Alyn, and Clwyd. The chief strata are Permian, carboniferous, and Devonian. Coal, and ores of iron, lead, silver, copper, and zinc are the chief mineral products and exports. In 1870, 3,281 tons of lead were raised from 24 mines. The soil is fertile in the plains and vales. In 1875, the total acreage under all kinds of crops, bare fallow, and grass was 124,834, of which 13,381 acres were under wheat, 11,146 under oats, and 7,607 under barley. Cotton is the main manufacture. The London, Chester, and Holyhead railway skirts the e. and n. shores. Pop. '71, 76,312. F. sends two members to parliament. The chief towns are Flint, formerly the county town; Mold, St. Asaph, Holywell, Rhyddlan, and Hawarden. F. has traces of Roman lead-mines, is traversed by Wat and Offa's dykes, and has some ancient castle and ecclesiastical ruins. In F., in the 7th c., Saxon invaders massacred 1200 Christian monks of the monastery of Bangor. In 796, the Saxons defeated the Welsh here with dreadful slaughter, which event gave rise to the still popular plaintive air of *Morfa Rhyddlan*.

FLINTY SLATE, of which there are beds in some parts of Scotland, and in many other countries, is an impure quartz, assuming a slaty structure. It contains about 75 per cent of silica, the remainder being lime, magnesia, oxide of iron, etc. Its fracture is rather splintery than shell-like. It is more or less translucent. It passes by insensible gradations into clay-slate, with which it is often in most intimate geological connection. Lydian stone (q.v.) is a variety of flinty slate.

FLOATING BATTERY is a hulk, heavily armed, and made as invulnerable as possible, used in defending harbors, or in attacks on marine fortresses. The most remarkable instance of their employment was by the French and Spaniards against Gibraltar, in the memorable siege which lasted from July, 1779, to Feb., 1783, when ten of these vessels, carrying 212 large guns, were brought to bear on the fortress; they had sides of great thickness, and were covered with sloping roofs, to cause the shot striking them to glance off innocuously. But their solidity and strength were unavailing against the courage and adroitness of the defenders, under the gallant gen. Elliot, who succeeded in destroying them with red-hot cannon-balls. Steam floating batteries of iron were constructed for the war with Russia in 1854, both by the British and French governments; but, notwithstanding that they rendered good service before Kinburn, they have since been generally discarded for other than purely defensive purposes, as too cumbrous for navigation, and too suffocating from the smoke that collected between their decks during action. Indeed, vessels of this class may be regarded as having been superseded for all purposes both of attack and defense by the newer kinds of gunboats and armor-clad frigates, as well as by the turret-ships (q.v.) which are among the more recent contrivances of skill in naval engineering.

FLOATING-DOCKS. So long as ships remained of a small size, no difficulty was found in effecting repairs on their hulls by the simple method of laying them on any convenient beach or sandbank at high-water. The receding tide would leave them high and dry for a few hours at a time; and by actively working at the repairs during low-water, they could generally be accomplished, without any special contrivance for taking the vessel out of the water. Even now this plan is not unfrequently resorted to, the part of the beach on which it is to be carried out being laid with parallel rows of timber beams, called collectively a *gridiron*. The rise and fall of the tides is in many localities insufficient for the purpose of leaving the hull dry at low-water, and the larger the ship the greater the risk of "beaching." Numerous plans have been adopted for getting at the bottoms of large vessels. A mode of heeling over ships was at one time very extensively used. A lighter of sufficient size and weight was provided with very powerful "heaving-down tackle," consisting of strong ropes passing through very large blocks. These tackles were made fast to the masts of the vessel, previously secured by extra stays, on the upper side, and then, by working the tackles, the hull of the vessel is heeled over on its side. Of course, this plan necessitates the removal of the whole of the cargo. By hauling the vessel over first on one side, and then on the other, the whole of the hull can be got at without difficulty. Of course, still water is required to carry out this method with safety. When there is no rise and fall of tide, the lighter is not required, as the tackle can be made fast to the quay or pier. It was while being careened over that the *Royal George* went down at Spithead in 1782, with 600 men on board. Graving or dry docks (q.v.) offer a very easy plan for repairing ships; but they are always very costly to construct, and in many localities sufficiently firm foundations are not attainable. Another common method of getting at the bottom of ships is by bringing them on to sloping ways, called *slips*, carried out from the yard a long distance under water, and then hauling them right up on to the shore end of the ways by means of suitable tackle, generally worked by hydraulic power. During the operation, the vessel rests upon a suitable carriage. Mr. Morton, of Leith, in 1818, invented a carriage for this purpose, which has contributed much to render this method of hauling up vessels easy.

Floating-docks have been in use for many years. Until of late years, they were built of timber, in the form of a large box with a flap-door falling down on strong hinges at one end. They are moored in still and shallow water, with a depth just sufficient to allow the vessel to float into them as they rest on the bottom. The flap-door is then raised up, and the water pumped out. These timber docks are incapable of being used in deep water, in consequence of their want of stability. If the vessel being docked happened to be so light that the dock began to float before the water was all pumped out of the dock, it was very apt to heel over, and thus cause the water to rush to one side, endangering both ship and dock. A considerable number of wooden floating-docks, of a size sufficient to dock large vessels, have been built in the United States of America. Some of these American docks have been built in sections—that is, a number of short docks are joined together to make a structure long enough to take in a long ship; but those wooden erections have little strength or durability.

It was not until the introduction of iron as the material for constructing them, that floating-docks were made capable of working in deep water, and able to take in the largest class of ships.

Mr. R. W. Thomson, C.E., of Edinburgh, designed in 1859 a great iron floating-dock for the port of Sourabaya, Java. Contrary to the method which had always before been adopted, Mr. Thomson determined to make every separate piece of the Sourabaya dock from drawings, and to dispense altogether with the costly operation of building up in this country. Some idea may be formed of the skill and care required for the proper fulfillment of this undertaking, when it is stated that there were upwards of 75,000 separate plates, ribs, and angle-irons, every one of them shaped, punched with numerous holes, and ready in every respect to be riveted into their places without any further

preparation. It was absolutely necessary that every one of the two millions of holes that were to be punched in all these plates and pieces of iron should be accurately in its right place. Mr. Thomson succeeded in carrying out his system so completely, that there were only about 450 separate forms to be made for all the 75,000 different pieces. By systematizing the work in this manner, it became possible to spend sufficient time and care on the making of drawings and templates for each of the separate 450 forms which composed the whole dock, to insure almost mathematical accuracy in the form of each piece, and in the positions of every hole in it. Another advantage of this method is the immense saving of labor in erecting the dock. Under the old plan of shaping each piece of iron so that it would fit only into one special place, it had to be searched for amid thousands of pieces similar to, and yet not capable of being substituted for it. The mere turning over of the innumerable plates and angle-irons in search for individual pieces becomes a source of great expense. Under Mr. Thomson's system, however, when the material for the docks is discharged from the ships, each of the 450 classes of pieces is piled up by itself, and the workmen have nothing more to do than to take the piece on the top of the pile, perfectly sure that it will fit accurately any of the hundred possible positions to which its class belongs. All the iron for the Sourabaya dock was used just as it came from the rolling-mills. The plates were all flat and rectangular, and the angle and T-iron all straight. The structure was so designed that no bending or heating of the pieces was required. It can easily be imagined that a dock so carefully planned would be cheaply made.

A transverse section of this dock would expose water-tight compartments, which were all completely under the command of the powerful centrifugal steam-pumps, so that they could be separately filled or emptied in a very short time. The dock could be heeled over to one side, for the purpose of getting at the bottom for repairing or cleaning it. This tilting over could be accomplished by filling the upper compartment on one side, and emptying all the others. The water-tight compartments were divided in their longitudinal direction into five separate divisions, making in all 25 water-tight compartments, any one of which could be filled or emptied at pleasure; thus affording complete command over the dock, and admitting of its being put into any required level, notwithstanding any irregularity in the distribution of the weight resting on the dock.

The French government had to provide a dry-dock at Saigon, in Cochin-China, for the use of the large steamers which had been subsidized by it to run between France and China. The soft muddy character of the soil at Saigon rendered the construction of a stone graving-dock impracticable. The French admiral, commander-in-chief of Cochin-China, hearing of the construction of the Sourabaya floating-dock, and having examined the plans of it, recommended his government to have a similar dock, on a much larger scale, constructed for Saigon.

The performances of the Saigon dock are in every way most satisfactory; it has lifted, high and dry out of the water, the 70-gun frigate *Persévérante*. Another great dock on Mr. Thomson's principle has been erected at Callao, and is likewise answering its purpose admirably. It has lifted out of the water many large vessels—among others, the U. S. man-of war *Wateree*, and the Peruvian iron-clad *Independencia*. The latter ship weighed 3,300 tons. As the Callao dock floats in an open roadstead, some apprehension was felt that the swell would cause too much movement to admit of ships being safely docked, but it has done its work in the most satisfactory way. None of these iron docks have doors or gates for excluding the water. The bottom part is made of sufficient buoyancy to float the vessels clear out of the water, and the equilibrium of the dock is maintained during the time it is under water, for the purpose of admitting a vessel, by the great displacement offered by the hollow sides.

One of the most remarkable of recently constructed floating-docks was that sent out to St. Thomas (West Indies) in 1867, and designed by Mr. Frederick J. Bramwell. It is 300 ft. long, 72 ft. wide clear between the sides, and has a double bottom 9 ft. 9 in. deep. The sides are open girders, not hollow boxes, as in the Sourabaya dock, and immense rectangular air-vessels called "floats," each about 47 ft. × 11 ft. × 5 ft., are placed between the side girders, and are capable of being moved up and down by screws in order to preserve the stability of the whole while it is being raised or lowered. By an accident which happened very soon after its arrival at St. Thomas, this dock was sunk, and a hurricane which followed close on its sinking, injured it still further. It remained under water for a long time, but was raised to the surface in Jan., 1871, after operations which lasted a year and a half, and were quite unique in their way. This dock, as originally constructed, could take in and lift a vessel not drawing more than 24 ft. and not weighing more than 4,000 tons. The weight of the dock itself, with the machinery all complete, is about 3,400 tons. The docks made by the Messrs. Rennie for Carthagena and Ferrol are even larger than the St. Thomas dock. The former weighs about 4,400 tons, and has lifted the Spanish iron-clad *Numancia*, weighing 5,600 tons, and supported it for 80 days.

FLOATING ISLANDS exist in some lakes, and more rarely in slow and placid rivers. Not unfrequently they are formed by the detachment of portions of the bank; the interlaced roots of plants forming a fabric sufficiently strong to endure the occasional

buffeting of waves, and to support soil for herbage or even trees to grow in. F. I. are often formed by aggregation of drift-wood in the creeks and bays of tropical rivers, and being wafted into the channel of the river when it is flooded or by the wind, are carried down to the sea, with the soil that has accumulated, and the vegetation that has established itself upon them. They are sometimes seen at a distance of 50 or 100 m. from the mouth of the Ganges, with living trees standing erect upon them. Portions of the alluvial soil from the deltas of rivers, held together by the roots of mangroves and other trees, are sometimes also carried out to sea after typhoons or hurricanes, and ships have, in consequence, been involved in unexpected dangers, as amongst the icebergs of colder latitudes. Imagination has always invested with a peculiar interest the

> Straggling plots, which to and froe doe rome
> In the wide waters:

and ancient legend did not fail to notice the floating islets of the sacred Vadimonian lake, which were large enough to bear away cattle that were tempted upon them by their fresh green grass; and the island of the Cutilian waters, which carried on its surface a dark and gloomy grove, and was constantly changing its place. A small lake in Artois, near St. Omer, is remarkable for the number of its F. I., as are also the marshy lakes of Comacchio, near the gulf of Venice. Among the largest in the world are those of the lake of Gerdau, in Prussia, which furnish pasturage for 100 head of cattle; and that of the lake of Kolk, in Osnabruck, which is covered with beautiful elms. Loch Lomond was long celebrated for its floating island; it, however, can no longer boast of one, as it has long since subsided and become stationary. F. I., are found in some lakes of Scotland, and also in Ireland, and consist for the most part of large floating masses of peat. Pennant gives a description of one which he saw in Breadalbane, the surface of which exhibited plenty of coarse grass; small willows, and even a little birch tree. More interesting to the scientific inquirer, as presenting a phenomenon not so easily explained, are those F. I. which from time to time appear and disappear in the same spot, of which there is one in the lake of Derwentwater in Cumberland, one in the lake Ralang in the province of Smalande in Sweden, and one in Ostrogothia. That in Derwentwater is opposite to the mouth of a stream called the Catgill; and the most probable of the many theories which have been proposed to account for it is that which ascribes it to the waters of the stream, when flooded by rains, getting beneath the interlaced and matted roots of the aquatic plants which there form, a close turf on the bottom of the lake. This floating island, when it rises above the water, is most elevated in the center, and on its being pierced with a fishing-rod, water has spouted up to the height of two feet.

The marshy ground of the vale of Cashmere, and particularly around the city of Cashmere, containing many lakes, and liable to inundations, exhibits a peculiar form of human industry in its numerous Floating Gardens, employed chiefly for the cultivation of cucumbers, melons, and water-melons. These floating gardens may be described as portions of the marshy ground artificially made to float, by cutting through the roots of the reeds, sedges, and other plants about 2 ft. below the surface, upon which mud is then spread. The floating of the garden secures the soil and crop from destruction by inundations.

Floating gardens existed on the lake of Mexico before the conquest of Mexico by the Spaniards. The Mexicans had made great progress in the art of gardening, and particularly in the cultivation of flowers, which were much used both in their festivities and in their worship. How they were induced to attempt the formation of floating gardens, and at what period it was first done, are mere matters of conjecture. The shallowness of a great part of the lake was favorable to the success of the attempt, and perhaps the gradual receding of its waters may be reckoned among the reasons of the gradual diminution of the number of the floating gardens, which have almost ceased to be reckoned among the wonders of the world. The abbé Clavigero, in his *History of Mexico*, describes them as formed of wicker-work, water-plants, and mud; as sometimes more than 20 poles in extent; the largest ones commonly having a small tree in the center, and sometimes a hut for the cultivator; and as employed for the cultivation both of flowers and culinary plants. Humboldt confirms this description, but states that the real floating gardens, or *chinampas*, are rapidly diminishing in number. The existing *chinampas* are in general not floating gardens, but plots of ground with very wide ditches between them, formed by heaping up earth from the ditches in the swamps or shallows at the side of the lake.

Great part of Bangkok, the capital of Siam, consists of floating houses. See Bangkok.

FLOATING WAREHOUSES. The danger that attends the storing of petroleum and other inflammable and explosive chemicals has led in France to the construction of warehouses, storehouses, or magazines that will float in a dock or basin, and can be moored at a distance from buildings on land. So far as concerns England, an act of parliament was passed in 1866, relating to the carriage and storing of dangerous substances; this law was amended and considerably extended by an act passed in 1875, applying to gunpowder and other explosive substances (including nitro-glycerine, dynamite, gun-cotton, blasting-powders, fulminate of mercury, fireworks, percussion caps,

etc.). This act requires such substances to be marked "gunpowder" or "explosive," and to be conveyed or stored with special precaution; it leaves much power to the secretary of state to intervene in special cases and arrange the precise conditions. The storing of petroleum is regulated by the act of 1871. In France, as we have said, F. W. have been constructed, two being finished in 1864, and others added in later years. The construction of the floating fabrics is remarkable. Each warehouse or magazine consists essentially of one hundred hollow iron cylinders, arranged in four rows of 25 each, firmly lashed or strapped together to form a kind of raft. Each cylinder, 16 ft. long by 6 or 7 in diameter, has hemispherical ends, with a man-hole at one end. They are placed upright when in position, so as to be filled with petroleum, glycerine, gunpowder, or any other substance, through the man-hole. As they will hold 25 tons each, their united capacity is 2,500 tons. There is a wooden covering to the top of the collected mass of cylinders, and round the sides as far down as the line of flotation, to shield the iron from fluctuations of temperature. This covering is made of thick planking, fastened to the cylinders by angle-irons which have been riveted to the latter. At the head and stern are large hawser-holes, to admit hawsers for towing and mooring the floating fabric, bringing it into and taking it out of a basin or dock, and warping it to a quay or dock wall; or, when the vessel is moored in the middle of a basin, far away from buildings, a barge may deliver or receive the dangerous cargo, and thus the vessel be kept altogether away from quays and wharfs.

FLOATSTONE, a variety of quartz, consisting of fibers—delicate crystals—aggregated so that the whole mass is sponge-like, and so light, owing to the air confined in the interstices, as to float for a while on water. It is found in a limestone of the chalk formation near Paris, in imbedded masses, or incrusting flint nodules.

FLOBECQ', a small t. of Belgium, in the province of Hainault, 20 m. n.e. of Tournai. It has extensive manufactures of linens, has breweries, salt-works, oil and flour mills, and has two fairs annually. Pop. 5,258.

FLODDEN, BATTLE OF. On the 24th Jan., 1502, a "perpetual peace" was concluded between England and Scotland. In the course of a few years, however, a series of petty quarrels had done much to bring this peaceable arrangement to a termination; and in 1513, on the invasion of France, Scotland's ancient ally, by Henry of England, a war broke out between the two countries. James IV., the chivalrous but rash king of Scotland, summoned the whole array of his kingdom to meet on the borough or common moor of Edinburgh, which extended from the southern walls of the city to the foot of the Braid hills, and which was then "a field spacious, and delightful by the shade of many stately and aged oaks." Here an army, it is said, of 100,000 men assembled. With this force James crossed the border on the 22d Aug., 1513; but instead of advancing at once, and achieving a decisive success, he lingered in the neighborhood of the Tweed until his army had become reduced by desertion to about 30,000 men. On the 6th Sept., James took up his position on Flodden hill, the last and lowest eminence of the Cheviots toward the n.e. On the morning of the 9th, the earl of Surrey, lieut.gen. of the northern counties of England, at the head of an army of about 32,000 men, advanced from the s.e., crossed the Till by a skillful and unexpected movement, and thus cut off all communication between king James and Scotland. While the English were crossing the Till, the Scots might have attacked them with every chance of success, and their not taking advantage of this opportunity was the first great mistake of the battle. Observing that the English were aiming at a strong position to the n.w. of Flodden hill, and desirous of preventing this, James, having ordered his tents to be set on fire, advanced against them in battle-array. The two armies were drawn up in similar order, each consisting of a center, a right and left wing, and a reserve placed behind the center. At about four o'clock on Friday, 9th Sept., the battle commenced with cannonading on both sides. The earls of Huntly and Home, who commanded the left wing of the Scottish army, charged the English right, which was led by sir Edmund Howard, and entirely defeated it. Instead, however, of following up their success, Home's borderers commenced pillaging the baggage of both armies; and Huntly, after his first charge, is said to have left the field. On the Scottish right, the clansmen under Lennox and Argyle, goaded to fury by the English archers, rushed forward, heedless of order, and fell with the greatest violence upon their opponents, who, however, received them with wonderful intrepidity and coolness, and at length put them to flight with great slaughter. Meantime, a desperate resistance was being made by the Scottish center, where the king fought on foot among his nobles. Scottish history presents no instance in which the national valor burned with a purer flame than in this. Hemmed in by outnumbering enemies, the king among his slender group of lords fought manfully until, when the night was closing on F., he fell pierced by an arrow, and mortally wounded in the head. The hill was held during the night by the Scots; but at dawn, learning the state of matters, they abandoned their position. Their loss amounted to from 8,000 to 10,000 men. "Scarce a Scottish family of eminence," says Scott, "but had an ancestor killed at Flodden." Besides the king, the archbishop of St. Andrews and twelve earls were among the slain. The English loss amounted to about 6,000 or 7,000; but Surrey's victory was so nearly a defeat that he was unable to

prosecute the war with any vigor. The sixth canto of sir Walter Scott's poem of *Marmion* contains a magnificent, and in the main an accurate, description of the battle.

FLODOARD, or FRODOART, 894–966; a French chronicler, and canon in Rheims. His works are the most important contributions to the French literature of the time. They consist of *Histoire de l'eglise à Rheims; Chronique sacrée* (a poetical history of Christ, the apostles, popes, saints, and martyrs of the church); and the *Chronicon rerum inter Francos gestarum*, beginning with 919 and ending with 966. This last work was translated and makes a part of Guizot's historical memoirs. It throws more light than any other document on the annals of the 10th century.

FLOGGING, ARMY AND NAVY. Corporal punishment has existed from time immemorial in the British army and navy; formerly having been inflicted upon slight occasion, and often with barbarous severity. In deference, however, to public opinion, it has been much less resorted to during recent years, and promises almost to disappear under a regulation of 1866. A man must now be convicted of one disgraceful offense against discipline before he can be liable to flogging for the next such offense; and even after one such degradation, he may be restored to the non-liable class by a year's good conduct. The punishment of flogging, which is generally administered with a whip or "cat" of nine tails on the bare back, cannot, under existing rules, exceed fifty lashes.

Corporal punishment is not recognized in the French army; but then the soldiers in that country are drawn by conscription from all ranks of society, and have, on an average, a higher moral tone than the British recruits, who, attracted by a bounty, volunteer usually from the lowest orders. On the other hand, the discipline in the French army, and especially during war on a foreign soil, is universally admitted to be inferior to the strict rule preserved among British troops. Soldiers and sailors being men unaccustomed to control their passions, and any breach of insubordination being fatal to the *esprit* of a force, unless summarily repressed, it is considered necessary to retain the power—however rarely exercised—of inflicting the painful and humiliating punishment of flogging. The French soldier, though escaping the ignominy of personal chastisement, is governed by a code harsher than our articles of war as actually administered; and the punishment of death, scarcely known in the British service during peace, is not unfrequently visited in France upon offenders against discipline.

FLOGGING, in the ARMY and NAVY (*ante*). This practice was long ago discontinued by the U. S. government. It may be noted, however, that under the statutes of one state (Delaware) it exists as a punishment for petty crimes.

FLOOD, HENRY, 1732–91; a politician and member of the Irish house of commons, where his eloquence gave him great popularity. He was privy counselor for the two kingdoms, and vice-treasurer for Ireland. He was also a member of the English house of commons, where he had a celebrated discussion with Grattan. He was the author of two or three poems of little importance.

FLOOD-PLAIN, land along a stream, little above the ordinary water-level, and often subject to overflow. The deposits made by successive floodings convert the land into a dry terrace.

FLOOR-CLOTH, a coarse canvas coated on both sides, and partly saturated with thick oil-paint, one side having usually a colored pattern printed upon it in oil-paint. The canvas basis for floor-cloth is chiefly manufactured in Dundee. As it is required to be without seam, and of sufficient width to cover considerable spaces of flooring, special looms are required for weaving it. It is made from 18 to 24 ft. in width, and in lengths from 100 to 113 yards.

The first step towards converting this canvas into floor-cloth consists in stretching it on a frame. This is a work of some difficulty, on account of the great size of the pieces. Some of the frames are as much as 100 ft. in length by 24 ft. in height, and the canvas must be stretched over it as tight as a drum. The back or plain side of the cloth is first operated upon, by *priming* it with a solution of size, and scouring it with pumice. The object of this is to prevent too much of the paint from penetrating the canvas, and rendering it brittle, and to make an even surface to receive the paint, which is mixed with linseed oil, with very little or no turpentine, and is consequently thicker than common paint. This is thrown or splashed upon the surface with a brush; and then with a long steel trowel the workman spreads the dabs of paint, and produces a tolerably smooth surface. This *trowel-color* is left for 12 or 14 days to dry, and then another coat is laid on in a similar manner; and this completes the back or under side of the floor-cloth.

While the first coat of the back is drying, the front is *primed* and pumiced, and a coat of trowel-color laid on. As more care is required on this side, this coat of color is scoured quite smooth with pumice, and two more trowel-colors are added, and each scoured like the first. Another coat is now carefully laid on with a brush, and is called a *brush-color*. This forms the ground upon which the pattern is to be printed.

The printing is done by means of wood-blocks. The pattern is first drawn and painted, in its complete form and colors, upon a piece of paper; another piece of paper is now laid under this, and the outlines of that portion of the pattern included in one color are pricked through to the lower paper. In like manner, pricked outlines of each

of the other colors are prepared. Each of these pricked sheets is laid upon a block of pear-tree wood, and dusted over with powdered charcoal or lampblack, and thus the pattern is drawn in dots upon the wood; the carver cuts away the wood surrounding the pattern, and leaves it standing in relief.

The pear-tree blocks are backed by gluing them to a piece of deal, and this piece again to another, with the fibers at right angles, to prevent warping.

The colors are spread by boys upon paddled cushions covered with floor-cloth, and each printer dabs his block upon that containing the required color, and then places it upon the floor-cloth, and striking it with the handle of a short heavy hammer, prints his portion of the pattern. He then proceeds with a repetition of this, and as he advances, he is followed in order by the printers of the other colors, who place their blocks accurately over the pattern the first has commenced. The first printer's chief care is to keep the repetitions of the pattern accurately in line.

The quality of floor-cloth depends mainly upon the number of coats of paint, the kind of medium used for the color, and the time given to drying. For the best qualities, a fortnight must elapse between the laying on of each coat, and finally, several months' exposure in the drying-room is necessary. As the rental of the space thus occupied, and the interest of the capital left stagnant during this time, amount to a considerable sum, there is a strong inducement to manufacturers to hasten the processes, which may easily be done by using gold size or boiled linseed oil, or other rapid "dryers," instead of raw linseed oil; but just in proportion as the drying is hastened by these means, the durability and flexibility of the floor-cloth are deteriorated. In order to secure the maximum of durability, floor-cloth should still be kept three or four years after it has left the drying-room of the manufacturer, and purchasers should always select those pieces which they have reason to believe have been the longest in stock. Narrow floor-cloth, for stair-carpeting, passages, etc., is made as above, and then cut into the required widths, and printed. It usually has a large pattern in the middle, and a border of a smaller design.

The laying of lobbies and passages with encaustic tiles has led to the superseding of floor-cloth in such situations, while for some other purposes, such as covering the floors of churches, reading-rooms, and waiting-rooms at railway-stations, it is superseded by the material called kamptulicon (q.v.), or vulcanized india-rubber cloth, which is impervious to wet, soft and quiet to the tread, and warm to the feet. This material is made plain or figured to resemble painted floor-cloth. See also LINOLEUM.

FLOORS—FLOORING, the horizontal partitions between the stories of a building, the upper part of which forms the floor of the apartments above, and the lower portion the ceiling of those below.

Floors are variously constructed, according to their dimensions, and to the weight they have to sustain. *Single-joisted floors* are the simplest and most cheaply constructed, and are used for ordinary buildings, where the distance between the bearings does not exceed 20, or, at most, 24 feet.

Joists are beams laid edge upwards, and resting at their ends upon wall-plates built into the walls. Their width should not be less than 2 in., for if narrower, they would be liable to split with the nailing of the flooring-boards. They are placed edge upwards, in order to economize timber, as the strength of a beam to bear a transverse strain varies simply with the breadth and with the square of the depth. See STRENGTH OF MATERIALS. When a deep and long joist is used, there is danger of its twisting or turning over; this is prevented by *strutting*, that is, nailing cross pieces of wood between them, or, less effectually, by driving pieces of planking between them. Strutting is required when the length of the joists exceeds 8 feet The laths for the ceiling of the room below are nailed to the bottom of the joists. In good, substantial work, the distance between the joists, from center to center, is about 12 in., but this is often exceeded in cheaply-built houses.

Double-joisted floors are constructed by laying strong timbers, called *binding-joists*, from wall to wall, at a distance of about 6 ft. apart; and a double set of joists, one above for the floor, and one below for the ceiling, are laid across these, and notched down upon them. These latter, when thus placed, are called *bridging-joists*, as they bridge over the interval between the larger binding-joists. This is adopted when a more perfect ceiling, free from cracks, produced by the yielding of the floor, is required, or where there is a difficulty in obtaining a sufficient amount of long timber for single joisting the whole of the floor.

The framed floor is one degree more complex than the double-joisted. Binding and bridging joists are used in the framed floor, but the binding joists cease to be the primary support, as for this purpose strong balks of timbers, called *girders*, are used. They are laid across, at distances of from 8 to 10 ft., and the binding-joists are framed into them by a *tusk-tenon* joint. See CARPENTRY. The bridging-joists are notched to these in the same manner as for double-joisted floors. A *bay* is the general name for the space between girders: if between a girder and wall, it is called a *tail bay;* or between two girders, a *case bay;* and the work between is described as a *bay of joisting*.

When the space to be spanned is too great for a simple wood-girder, trussed or built up wooden girders or iron girders are used: the latter have, of late, come into extensive use, even where simple wood-girders are applicable. See GIRDER.

With a given quantity of timber, and a moderate space, the single-joisted floor is the strongest of any. One of its disadvantages is the free communication of sound to the apartment below, unless some additional means of obstructing the sound be adopted.

When first laid, the floor should be rather high in the center, to allow for settling at the joints; and when settled, it should be perfectly level, for if it rises in the middle, it will exert an outward thrust upon the walls, and if hollow, it will pull inwards; but if level, its whole strain is perpendicular.

The flooring-boards are usually nailed to the joists, and vary from 1 to 1½ in. in thickness; for common floors they are from 7 to 9 in. wide, but for better floors a width of only 3 to 5 in. is used. The advantage of the narrow boards is, that the shrinkage and warping have not so much effect on the spaces between. This refers to the ordinary deal-flooring used in modern British domestic buildings. The facing of the floor in many old mansions is formed of small pieces of oak carefully inlaid. See PARQUETRY. For other kinds of inlaid fancy floors, see MOSAIC, ENCAUSTIC TILES, and CONCRETE. In France, and most of the southern continental countries, where carpets are rarely used, the flooring-boards of the better class of houses are made of hard wood, carefully and closely jointed, and these floors are commonly rubbed with bees-wax, and polished. In humbler dwellings, even the bedrooms are paved with tiles, or strong plaster, or concrete; and, considering the prevalence of fleas, etc., in such places, they are certainly better adapted for them than our deal-boards and carpets. They may be freely sprinkled, and even swilled with water in hot weather.

For warehouses where heavy goods are stored, for ball-rooms, etc., special construction is required to adapt the floor to the strain put upon it.

FLO'RA, among the Romans, was the name of the goddess of flowers, and of the spring, and was latterly identified with the Greek *Chloris*. Her temple was situated in the vicinity of the *circus maximus*. The worship of F. was one of the oldest manifestations of the Roman religious feeling, and is affirmed to have been introduced by Numa. The *floralia*, or festivals in honor of the goddess, were first instituted 238 B.C., and were celebrated from the 28th of April to the 1st of May, with much licentious merriment, prostitutes playing an important part on such occasions. On coins, F. is represented with a crown of flowers.—In botany, the term F. is a collective name for plants, and is used with regard to the vegetable kingdom in the same way as the term *fauna* with regard to the animal. It is common to speak of the F. of a country or district; and a work devoted to the botany of a country or district, is often entitled a F. of that region.

FLORÉAL, the 8th month in the French republican calendar, corresponding with the last third of April and the first two thirds of May. The name signifies "flowering" or "flowering month."

FLORENCE, a province in Tuscany, Italy, bordering on Bologna; 2,263 sq.m.; pop. '72, 766,824. The Apennines traverse the e. part of the province. The Arno is the principal river. Three railroads pass through it. Agriculture is a prominent business of the people. Excellent wine is produced. There is extensive cattle breeding and olive cultivation, and some mining. Florence is the chief city and capital.

FLORENCE, a village and seat of justice in Lauderdale co., Ala., at the head of navigation on the Tennessee river, at the lower end of Muscle shoals, connected by rail with Tuscumbia and the Memphis and Charleston railroad; pop. 2,003. It has the Florence synodical college, a normal college, a seminary for girls, a number of cotton manufactories, and considerable river trade.

FLORENCE, a village in Idaho co., Idaho, about 160 m. n. of Boisé city; supposed to be the highest inhabited town in the United States, being over 11,000 ft. above the sea level. The mountain on which it stands rises 2,000 ft. above it. It has profitable mines of gold.

FLOR'ENCE (Ital. FIRENZE), a city of Italy, capital of the former duchy of Tuscany, is situated in the valley of the Arno, in lat. 43° 46' n., and long. 11° 15' east. It is about 123 ft. above the level of the sea, 60 m. from Leghorn, 40 from Siena, and 44 from Arezzo. Pop. '71, 167,093. The Arno, spanned by four fine bridges, divides the city into two unequal parts, the chief of which stands on the northern bank of the river. In shape, an irregular pentagon, F. is inclosed by walls of about 6 m. in extent, and communicates with the exterior by means of eight gates, which conduct to thickly peopled suburbs, and a lovely, fertile, and salubrious neighborhood, encircled by sloping hills, and studded with picturesque villas and fruitful vineyards and gardens. F. and her environs, viewed from the heights of Fiesole, appear but one vast city. The influx of population consequent on the establishment here, in 1865, of the seat of the Italian government, necessitated a considerable extension of the city, and it is now nearly double its former extent. Many causes render this city a most attractive place of residence to foreigners—a lovely country and healthful climate, cheap living, and the universal courteous intelligence of the people, united to the immense sources of interest possessed by the city in her grand historical monuments and collections of art. The massive and austere forms of Florentine architecture impart an air of gloomy grandeur to the streets, for the most part regular and well kept. The chief monuments of the city are Il Duomo,

or the cathedral, the foundations of which were laid with great solemnity in 1298. The Florentines having ambitiously resolved on erecting a monument which for architectural splendor and proportions should outvie all preceding structures, the honor of preparing the design was intrusted to Arnolfo de Cambio da Colle. On his death Giotto superintended the works; and many eminent architects were employed before this splendid edifice was completed—Brunelleschi, the last, conceived and erected the grand cupola, so much admired by Michael Angelo as to have served him as a model for that of St. Peter's. At the side of the cathedral springs up the light and elegant bell-tower, detached, according to the custom of the times. In front is the baptistery of San Giovanni, in form an octagon, supporting a cupola and lantern; all three edifices being entirely coated with a varied mosaic of black and white marble. Three bronze gates in basso-rilievo are a great additional adornment of the baptistery; the two by Ghiberti have been immortalized by Michael Angelo with the name of gates of paradise. See Sgrilli's description. The church of the Santa Croce, the pantheon of F. (built in 1294—architect, Arnolfo), contains monuments to Galileo, Dante, Macchiavelli, Michael Angelo, Alfieri, etc. The church of San Lorenzo was consecrated as early as 393 by St. Ambrose, and rebuilt by Brunelleschi in 1425, by command of Giovanni and Cosmo de' Medici. It contains an interesting monumental memorial of Cosmo il Vecchio, bearing inscribed the title *Pater Patriæ* which had been conferred on his memory by public suffrage the year following his death. In the *Nuova Sagrestia*, or new sacristy, are the two famous monuments of Michael Angelo to Julian and Lorenzo de' Medici. The figures of these two statues are marvels of deep and living expression, and unsurpassable in their mute and eloquent beauty. The Medicean chapel, gorgeous with the rarest marbles and most costly stones, agate, lapis lazuli, chalcedony, etc., stands behind the choir, and contains the tombs of the Medici family, and those of the grand dukes their successors. Annexed to the church is the Laurentian library, with its inexhaustible store of rare MSS., founded by Giulio de' Medici. Bandini has published the catalogue of the Greek, Latin, and Italian MSS.; and Biscioni and Assemani those of the Hebrew and oriental ones. Amongst the numerous palaces, *Il Bargello*, now converted into a prison, is one of the most ancient, and was formerly the abode of the republican magistrate, the podestà. In 1841, some interesting portraits were brought to light by the removal of a coating of whitewash from the revered features of Dante, Brunetto Latini, Corso Donati, etc., in the chapel of the palace. The palazzo Vecchio, the seat of the republican government from its establishment till 1530, when it was abolished, is an imposing mass of building, surmounted by a lofty tower 260 ft. high, the great bell of which used to warn the citizens of danger or summon them to defense. Adjoining the palace is the piazza del palazzo Vecchio, a square containing a fine collection of statues, and a noble arcade, the loggia de' Lanzi, under the porticos of which are magnificent groups of sculpture (see Rastelli's *Illustrazione Storica del Palazzo della Signoria detto Palazzo Vecchio*); Gli Uffizi, a handsome building between the palazzo Vecchio and the Arno, founded by Cosmo I., in the first floor of which are deposited the archives of the court of justice and other public offices, also the Magliabechi library of 150,000 volumes, and 12,000 MSS. On the second floor, in a circular suite of 23 rooms, is contained the famous Florentine gallery of art; rich in paintings, engravings, sculpture, bronzes, coins, gems, and mosaics. A splendid apartment, known as the tribuna, contains the rarest treasures of the collection, and is in itself a wonder of art, with its cupola inlaid with mother of pearl, and its rich marble pavement. The palazzo Pitti, the modern grand ducal residence, boasts of a superb gallery of paintings, and of a collection of 70,000 rare volumes, and 1500 MSS.

The palazzo Riccardi, now public property, is much frequented for its fine library. The palazzo Strozzi is a fine type of Tuscan architecture. Florence abounds in other public edifices and monuments well meriting notice, but our limits oblige us to omit all mention of them. The practical and philanthropical institutions are also numerous and excellently organized. The hospital of Santa Maria Nuova contains a college of medicine and surgery, which enjoys a European fame. The academy of the fine arts and the museum of natural history afford unlimited resources to the public interested in their collections. There are 8 hospitals, 1 lunatic asylum, 9 theaters. The academy della Crusca is intrusted with the care of sifting and preserving uncorrupted the Italian language. The academy dei Georgofili was established in the interests of agriculture, the progress and needs of which it reports quarterly in the *Giornale Agrario Toscano*. For a detailed description of F., see *Guida della Città di Firenze*, 1822. The chief industrial occupations of the Florentines are the fabrication of silk and woolen textures, and of straw-plaiting for hats, etc., jewelry, and exquisite mosaics in rare stones. Education is more diffused in Tuscany than in any other Italian state; and the Florentines are famous for their caustic wit and natural gifts of eloquence, as well as for their shrewd thriftiness and unflagging labor. In their moral superiority to other states may be recognized the effects of a better and more upright government than those which existed in most of the other divisions of the peninsula previous to the late partial union of Italy.

History of Florence.—The city of F. sprang originally from Fiesole (q.v.), at the foot of which it lies extended. The inconvenient and hilly site of the Etruscan Fiesole, perched on the crest of an irregular height, rendered the town so difficult of access to the traders who resorted to its market-places with their varied merchandise, that it was

at length decreed they should assemble at the base of the hill, in the fertile plain traversed by the Arno. The few rough shelters erected for the accommodation of these traders may be considered the original nucleus of the important and splendid city of Florence. Such at least is the traditionary history of its origin generally accepted by the Florentine historians. It would seem that as early as the time of Sulla there had been a Roman colony here; another was sent after the death of Julius Cæsar, and it soon became a thriving town. The *Florentini* are mentioned by Tacitus, 16 A.D., as sending delegates to Rome, but it was not till the time of Charlemagne that F. began to rise out of obscurity. It was now governed by a political head with the title of duke, assisted by various subordinate officers, who were elected by the united suffrages of the duke and citizens. In the 11th c., F., and a great part of Tuscany, were bequeathed to pope Gregory VII., by his friend and partisan the countess Matilda, who inherited from her mother, the countess Beatrix, her jurisdiction over the city. Under the protection of Rome, F. speedily adopted the forms and institutions of a free city: and the republican spirit which then arose amongst the people imparted an impulse to national and individual life, and awoke a spirit of ardent patriotism and splendid enterprise. As early as the 11th c., the Florentines were European traders, and the possessors of grand commercial depots in the seaports and cities of France and England, and their skill as workers in gold and jewels had grown proverbial. In proportion as papal preponderance increased in F., that of the empire sank; and in 1113 the citizen forces routed the troops, and slew the delegate of the emperor at Monte Cascioli, near Florence. During the bitter wars between pope and empire, F. and all Tuscany seemed to have been saved from the civil feuds which raged throughout Italy between the contending factions of Guelphs and Ghibellines; the former, adherents of the pope; the latter, of the empire. But in 1215, F. became involved in the great party struggle, owing to a private feud breaking out between two noble families, chiefs of the contending principles. A Guelph noble, Buondelmonti, mortally incensed the Ghibelline family of the Amidei, by breaking off his alliance with a daughter of their house, and contracting marriage with a member of the Guelph family. To avenge this insult, the Amidei appealed to their powerful kinsmen, the Uberti, and, in fact, to all the Ghibelline party of Florence. Buondelmonti was stabbed to death as he crossed the bridge of the Ponte Vecchio, and was speedily avenged by the Guelphs in the blood of his enemies. Thus for 33 years was F. distracted by the deeds of bloodshed and violence of these two rival factions, who assumed the names, and adopted the respective causes of Guelph and Ghibelline. See GUELPH AND GHIBELLINE. In 1250, the animosity of these parties seemed somewhat blunted, and public attention was directed to wise internal reforms. Twelve magistrates, or anziani, were appointed in place of the consuls, each of the six sections into which the city was divided being intrusted to two of these magistrates, whose tenure of office was annual. To avoid all local dissensions, two other magistrates, strangers by birth, were elected: the one, invested with supreme authority in civil and criminal cases, was called the podestà; the other, with the title of captain of the people, had the chief command of the militia, in which were enrolled all the youth of the state, who were bound, at the call of this magistrate, to join their company fully equipped for fight: 20 companies defended the town, 96 the country. After the death of the emperor Frederick II., the great protector of the Ghibellines, the Guelph or papal party gradually rose in power in F., and during ten years of their predominance, the city ascended in grandeur and prosperity, until it stood not only the first in Tuscany, but one of the first of all Italy. In 1254, the Florentines first coined their noble golden florin, unequaled at the time for beauty: in weight, a dram, it bore on one side the national emblem, a lily; and on the reverse, the effigy of the popular patron, St. John the Baptist. It commemorated a period of great success in the annals of F., whose forces had successively humbled the adjoining towns of Siena, Arezzo, Pisa, and Pistoja in 1252, and in 1254 captured Volterra. In 1260, the standard of civil war was again raised by the Ghibellines of F., who, in league with Manfred of Naples, attacked the Guelphs, and cut their forces to pieces in the sanguinary battle of Monte Aperto. The conquerors entered F. forthwith in the name of Manfred, abolished all trace of the popular institutions, establishing an exclusively aristocratic executive, and even strongly advocated the entire destruction of the city, the hotbed of Guelphism. This barbarous scheme was indignantly repudiated by their own famous leader, Farinata degli Uberti, immortalized by Dante for his patriotism. He declared his intention of heading the Guelphs, were such a sacrilege perpetrated by his own party. Pope Urban IV., French by birth, summoned against the Ghibelline Manfred a French army, led by Charles of Valois, to whom he offered the prospective kingdom of the Two Sicilies. Manfred was defeated and slain in the famous battle of Benevento, and Guelph ascendency was restored anew throughout Italy and Florence. Charles fully restored to the Florentines their internal institutions, and received their offered allegiance for ten years, 1266. In 1282, the *priori*, a new executive power, was established in F.; and in 1293, by the consent of the priori, a higher chief than their own order was elected, with the title of *gonfaloniere*. In 1300, Dante became one of the priori, and the former feud was recommenced with new vigor between two factions, who bore the names of Bianchi (whites) and Neri (blacks). Their dissensions were, however, interrupted by the appearance of Charles of Valois, sent by Boniface VIII. to restore tranquillity, 1301. Charles espoused

the part of the Guelphs or Neri, and sanctioned every outrage on the Bianchi, who were plundered and murdered barbarously, the survivors being exiled and beggared; among these were Dante, and Petracco dell' Ancisa, the father of Petrarca. In 1306, Pistoja was besieged, and taken by famine with great barbarity, In 1315, the Florentines met with a severe check from the Ghibellines of Pisa, under the command of Uguccione della Faggiula; and in 1325, were completely defeated by Uguccione's successor in command, the valiant Castruccio Castracani, in the battle of Altopascio. F., weakened by long dissensions, and alarmed by Castruccio's threat of marching on the city, appealed to the king of Naples for aid. They received joyfully an officer of the king, entitled the duke of Athens, sent as royal vicar; and such was the public demoralization of the moment, they proclaimed him dictator of the republic, unanimously suppressing the offices of priori and gonfaloniere. The intrigues of this ignoble schemer to overturn the republic being discovered, he was ignominiously expelled by a general popular rising, and narrowly preserved his life. An attempt to admit a proportion of the nobles into the government signally failed at this time, and only led to renewed animosity between them and the citizens. This was the last effort of the nobles to secure power. See Macchiavelli, book ii. A terrible pest decimated F. in 1348, sweeping off 100,000 of her inhabitants. See Boccaccio, *Decameron*. The chief power of F. about this time seems to have been alternately wielded by the democratic families, the Alberti and the Ricci, and by their patrician rivals, the Albizzi, who, for the space of 53 years, guided the republic in the path of independence and progress. In 1406, the ancient and illustrious republic of Pisa (q.v.) fell under the sway of F., after a most heroic resistance. From 1434, the history of F. is intimately bound up with the house of Medici, whose influence supplanted that of the Albizzi. See Medici. The Medici were repeatedly banished from F., in consequence of their aiming at sovereign power; and to their intrigues F. owes her final loss of republican rights and institutions. Pope Clement VII., of the house of Medici, formed a league with the emperor Charles V., by which the liberties of F. were to be extinguished, and the sovereign power to be invested in the pope's bastard son, Alexander de' Medici. In Sept., 1529, an army of imperialists, under the duke of Orange, entered Tuscany; and on the 8th of Aug., 1530, the siege of F. terminated, after a defense of unexampled devotion and bravery on the part of the citizens. Thus fell the name and form of the republic of F., quenched in the best blood of the city, a sacrifice to a renegade pope, who employed both foreign robbers and internal traitors to destroy and humiliate the city of his birth. From this period F. loses her distinctive history, and is only known as capital of the grand duchy of Tuscany, pope Clement having conferred on Cosmo de' Medici the ducal dignity. Some idea of the splendor and prosperity of F. as a republic may be had from the fact that her capitalists were so enormously wealthy, they supplied the chief sovereigns of Europe with funds; her manufactures of wool, silk, and gold brocade were exported throughout the world; and besides home centers of commerce, she possessed great commercial establishments in all the countries of Europe. This wonderful prosperity the Florentines owed solely to their indomitable spirit of enterprise. F. was for a time the capital of the new kingdom of Italy, but in 1871, had to yield the honor to Rome. The province of F. or Firenze has an area of 2,260 sq.m., and a pop. of (1871) 766,326.

FLORENCE, Council of, in continuance of the council of Ferrara (which see), assembled in 1439. The proposed reunion of the eastern and western churches was the great object sought to be accomplished—the pope desiring it as a means of triumph over his adversaries in the council of Basle, which was still in session, and the emperor longing for it in order to secure the help of the west against the Turks. The discussions, commenced at Ferrara, were resumed on the four chief points of difference: 1, the addition of "filioque" to the creed; 2, the use of unleavened bread in the eucharist; 3, purgatory; 4, the papal supremacy. On the first three, compromises were effected, and the last the Greeks, in a great degree, accepted. The formal decree of union was drawn up and signed by the pope and many others on the part of the Latins, and by the emperor and many of his chief dignitaries in behalf of the Greeks. But the union, having been prompted only by political necessities and having no place in the hearts of the Greeks, was soon openly denounced and brought to nought. Many of those who had signed the decree, on their return home recanted, saying, "Alas! we have been seduced by distress, by fraud, and by the hopes and fears of a transitory life. The hand that has signed the union should be cut off, and the tongue that has pronounced the Latin creed deserves to be torn from the root." In April, 1442, the sessions of the council were transferred to Rome.

FLORENTINE WORK. See Pietra Dura, *ante*.

FLO'RÊS, as the name of various islands, occurs in Asia, North America, South America, and the Azores.—1. In the Malayan archipelago, about half-way between Java and the eastern extremity of the chain. It lies due s. from Celebes, in 8° to 9° s. lat., and 120° to 123° e. longitude. Like most members of the group, it is of an oblong shape, measuring 200 m. in length by an average breadth of 35, and is of hilly character and volcanic origin. It produces cotton, sandal-wood, and bees-wax; and its principal trade is with Singapore.—2. The most westerly of the Azores, with a pop. of about 10,000—lat. 39° 25′ n., and long. 31° 12′ west.—3. In the Pacific ocean, a little to the w. of Van-

couver island—lat. 49° 20′ n., and long. 126° west.—4. In the Plata, about 20 m. below Montevideo, in the republic of Uruguay, in lat. 34° 56′ s., and long. 55° 55′ west.

FLO'RET. See FLOWER.

FLORIAN, JEAN PIERRE CLARIS DE, 1755–94; a French poet and writer of romances. He was early introduced to Voltaire, and when 13 years old became a page of the duke of Penthièvre, who remained his patron. For a short time he was in the army, but soon returned to the quieter life of his patron's house, where he devoted himself to literary pursuits. At the outbreak of the revolution he was imprisoned. He was soon liberated, but survied his release only a few months. In 1782, he brought out an epistle in verse entitled *Voltaire et le Serf du Mont Jura*, which was crowned by the French academy. The same honor was given the following year to *Ruth*, an eclogue. This was followed the same year by *Galatée*, an imitation of Cervantes, and two years later by *Numa Pompilius*, an imitation of Fénelon's *Telemaque*. A pastoral entitled *Estelle* is esteemed the best of his works. In 1791, he published *Gonzalve de Cordone*, a romance, and in 1792 a collection of *Fables*. He began, but did not complete, a romance founded on the story of William Tell. This occupied him during his imprisonment, when he also made an abridgment of *Don Quixote*, which was published after his death. Some of his best writings are his fables, comedies, and minor tales. In 1788, he was made a member of the French academy.

FLORIAN, SAINT, 190–230; the patron saint of Poland; b. in Austria, served as a capt. in the Roman army, and was drowned during the Diocletian persecution. It is said that he was buried on the site of the monastery of St. Florian, near Linz; but that the remains were afterwards taken to Rome. In 1183, a portion of them was presented to king Casimir, and thenceforward Florian became Poland's patron saint. He is represented as pouring flames from a vessel, and is invoked for protection against fire. Aug. 4 is his day.

FLORICULTURE, or CULTIVATION OF FLOWERS. From the earliest times, and wherever any considerable progress has been made in civilization, plants have been cultivated for the sake of their beautiful or fragrant flowers. Flowers have been very generally employed not only to afford gratification, and for the adornment of the person and of houses, particularly on festive occasions, but in many countries also in connection with religious rites. Flower-markets existed in ancient Athens, as in the richest capitals of the modern world. India, China, and Mexico have been famous for the cultivation of flowers, from the earliest periods to which their history can be accurately traced. Artificial means have been employed for the protection and cultivation of delicate exotics, prized only on account of their flowers, far more generally and assiduously than for the cultivation of any fruit-bearing, culinary, or otherwise useful plants. Those who cannot afford more than a very small green-house, almost always devote it to flowers; and those who cannot attain even this, have a few favored plants under a frame, or at least in a window.

Flowers are either cultivated in borders of a garden mainly appropriated to fruit-trees and culinary vegetables, or a separate flower-garden is formed, consisting generally of parterres cut out of a lawn. Of late years, the separate flower-garden has become much more common than formerly. There is much room for the display of taste in the form and grouping of its parterres, and both in it and in the humbler flower-border, in the arrangement of the flowers themselves. A common rule has always been to place the plants of tallest growth generally at the greatest distance from the walks or alleys from which they are to be viewed, and those which scarcely rise above the ground, nearest to the spectator: it is also of evident importance, except in extensive gardens, that every border or parterre should be gay with flowers during all the spring, summer, and autumn, on which account attention must be paid to the intermixing of plants that flower at different seasons, and for this purpose annuals are often sown amongst perennial plants and shrubs; whilst it is always necessary to take care that the combination of colors be such as to please and not offend the eye, in order to which *complementary colors* are brought together—red and green, blue and orange, yellow and violet—whilst a judicious mixture of white blends and harmonizes those which would otherwise appear unpleasantly contrasted. This rule is equally applicable to the grouping of flowers in one border, or of parterres in which masses of the same color are exhibited, often produced by an extensive planting of the same flower, a practice which has recently become common, and by which the greatest splendor of general effect is produced.

The flower-garden requires the same attention to the habits of particular species, and the same assiduity in digging, cleaning, etc., which are requisite in other departments of horticulture. Perennial herbaceous plants generally require to be not unfrequently renewed by parting of the roots or otherwise, as the tuft extends and the flowering stems become more numerous, but weaker and less productive. Many plants are placed in the flower-garden in summer, which require the protection of the frame or green-house in winter.

In no department of horticulture have greater changes been effected by cultivation. Even the practiced eye has often some difficulty in recognizing the splendid varieties which the florist has produced, as the progeny of the unpromising original form. One

of the most common effects of cultivation is the production of double flowers, in which the stamens have been converted into petals, as in roses, so that if the flower is perfectly double, it can produce no seed by itself; or, in the case of composite flowers, the florets of the disk assume the same form with the florets of the ray, as in dahlias, asters, etc. Much improvement has been effected by crossing, not so frequently by the real hybridization of different species, as by the intermixture of artificial varieties already obtained; and many of the finest varieties are the mere result of the careful selection and cultivation of individual plants of superior beauty, and of their progeny.

The greenhouse, conservatory, stove, etc., in which exotic flowers are cultivated, are noticed in separate articles. But perhaps this article would not be complete without some notice of *window-gardening*, by which a charm is added even to the abodes of the wealthy, particularly in cities, and by which even the poor have the delight of tending a choice exotic or two, and becoming familiar with the beauty of their flowers. The care requisite in window-gardening is the same as for plants kept in flower-pots in the green house; there must be the same re-potting, pruning of the roots, etc., from time to time, and at least as much attention in giving water and air. Of the former, the most common mistake is to give too much, and of the latter too little. It is a good rule, that except immediately after water is given, it should never be seen in the saucer; nor should the earth appear *very* moist. The situation, however, being in many respects less favorable, many plants, as heaths, which are frequent in greenhouses, cannot be successfully cultivated in the windows of apartments. The common notion that the burning of gas in apartments injures window-plants, does not appear to be well founded. WARDIAN CASES, by means of which many delicate plants are produced in the greatest perfection in the windows of apartments, are noticed in a separate article.

Horticultural societies (q.v.) have of late done much for the encouragement of the cultivation of flowers, and particularly among the humbler classes of society, with evident increase of amenity within and around their abodes, and an unquestionable tendency to refinement of habits and feelings.

FLOR'IDA, the name of the most southerly and most nearly tropical member of the United States of North America. Including its adjacent islands and its reef-like chain of keys on the s.w., it stretches in n. lat. between 25° and 31°, and in w. long. between 80° and 87° 44'. The greater portion of it forms a peninsula stretching s.s.e. towards the Bahamas, having the Atlantic on the one side, and the gulf of Mexico on the other. It adjoins, on the n., the states of Georgia and Alabama. Its greatest breadth, from the Atlantic to the river Perdido, is 360 m.; its greatest length about 400 m.; the average breadth of the peninsular portion upwards of 120 m.; area, 60,000 sq. miles. The principal rivers are the St. John's, running n.e. through the peninsula, and entering the sea near Jacksonville after a course of 300 m.; the Suwanee, flowing s. from Georgia into the Mexican gulf at Vacassar bay; the Appalachicola, the Choctawhatchee, Escambia, and Perdido. The principal towns are Tallahassee, the seat of government, situated near the middle of the northern boundary; Jacksonville; Key West; St. Mark's on the gulf; St. Augustine on the Atlantic, the Spanish capital, and the oldest settlement in Anglo-Saxon America; and Pensacola, a port near the Perdido, in the extreme w. of the state, recently rendered so conspicuous in the war of secession.

In physical character, the state, generally speaking, is part of the sandy and marshy belt which forms the immediate seaboard from the Potomac to the Mississippi. Nay, far beyond the average of the contiguous shores in either direction, it may, almost without a metaphor, be described as amphibious. To say nothing of inlets, which carry the tide within 50 m. of every point, the interior may literally be said to teem with fresh water, here and there welling up into considerable streams from springs ranging to 250 fathoms in depth. This is more emphatically true of the s., where an immense district, known as everglades, exhibits, as its normal condition, the ordinary phenomena of a casual inundation. Though the surface is thus better adapted to pasturage than to tillage, yet, in favorable localities, the soil, rather through the abundance of heat and moisture than from any inherent fertility, largely yields such productions as sugar, cotton, and rice. Considering that the state shares with the Bahamas the dominion of that grand highway of commerce, the gulf stream (q.v.), its inexhaustible growth of timber for ship-building is peculiarly valuable. Its coasts and rivers swarm with shoals of fish; while its dependent keys, periodically crusted with salt of the sun's making, furnish the means of curing them.—*Florida*, so called because of its exuberant vegetation, was first made known to Europeans by Ponce de Leon, who landed near St. Augustine in 1512. In 1539, it was explored by Fernando de Soto. Originally, the term F. vaguely indicated among the Spaniards the eastern side of the new continent to the n. of Mexico, just as the term California received a similarly loose interpretation on the western coast. Gradually, however, it came to be circumscribed by the encroachments of rival powers —its first definite boundaries being established with reference to the claims of English Georgia and French Louisiana. Even within these limits, it embraced, in addition to the F. of the present day, the maritime borders of Alabama and Mississippi. Thus fixed in position and extent the colony was ceded to England in 1763, and recovered by Spain in 1781. Louisiana having been bought by the United States from France in 1803, in 1821 F. was also annexed to the republic by a mixture of force and negotiation.

The same physical character of F. which impairs its economical worth, has added materially to the expense of its occupation. From about 1836 to 1842, the Seminole Indians, protected by their swamps, tasked the resources of the American union more than any other domain of equal size ever tasked them. Notwithstanding every drawback, the country, possessing, as it does, a comparatively salubrious climate, has made a reasonable progress in wealth and population. In 1870, 2,373,541 acres were in farms, of which 736,172 acres were improved, producing 2,225,056 bushels of Indian corn and 39,789 bales of cotton, besides other crops. The value of the assessed property in the same year was $32,480,848, and the public debt in 1873 was $5,844,800. Railways have only recently been introduced; in Jan., 1875, of 700 m. projected, 496 were completed. The number of schools in the state in 1873 was 444, with a total attendance of 16,258 pupils. In 1868 the legislature of F. agreed to the fourteenth amendment of the constitution of the United States, and was recognized as one of the states in the union. It sends two members to the house of representatives, besides possessing the two senators belonging to every state.

FLORIDA (*ante*), so called by the Spaniards because discovered on or about Easter (some say Palm Sunday, *Pascua Florida*), or because of the number of flowers that covered the country. Ponce de Leon, in search of the fountain of youth, was the first European to visit Florida, landing near the present St. Augustine in 1512. Vasquez, Verrazano, and De Geray successively visited the country in 1520–24. In 1526, Charles V. granted to Pamfilio de Narvaez all the land from the extreme s. to the river Panuco. Narvaez took possession in 1528 with a large force, but met a strong resistance from the Indians, and finally perished by shipwreck off the coast, only 10 of his company of 440 living to reach Spain. In 1539, De Soto made an exploration, and a few years later (1562–64) a considerable number of French Huguenots sought refuge in Florida, but they were expelled by the Spaniards in 1565, "not as Frenchmen, but as heretics," as was learned from the placards attached to some who were hung on trees. This ferocity was as grimly repaid by the French, who captured the Spanish fort and strung up its defenders on the same trees, "not as Spaniards, but as cut-throats and murderers," leaving the writhing bodies side by side with the dry bones of the Huguenots. The Spaniards established a fort at St. Augustine in 1565, which was captured in 1586 by sir Francis Drake, who found that two Englishmen had taken nominal possession of the country two years earlier. It does not appear that England undertook to hold possession, and there followed nearly a hundred years during which little was heard of the land of flowers; but in 1682, La Salle, the explorer of the Mississippi, was in w. Florida, and in 1696 the Spaniards made a settlement at Pensacola. The English repeatedly attacked St. Augustine, alleging that the place was a haunt of freebooters. In 1763, Florida was ceded to England in exchange for Cuba As soon as it was one of the English colonies, emigrants from the north began to settle, but in 1783, with the coming of our independence Florida was given back to Spain. After the purchase of Louisiana in 1803, there was much discussion about the boundaries between the new territory and Florida, but the Perdido river now separating Florida from Alabama was fixed upon. In the war of 1812, the British organized expeditions against the United States in Florida, and gen. Jackson captured Pensacola as one of the offending towns, but it was soon restored to Spain.

By treaty and purchase, Florida became a part of the United States territory in July, 1821, and the next year was organized and a governor (gen. Jackson) appointed. Immigration again became rapid, but the warlike Seminoles who dwelt in the impenetrable everglades were a constant source of danger, and desultory war was almost constant. After years of fighting that cost the United States more than $10,000,000 and 1500 lives, the Indians were prevailed upon to migrate to the territory w. of the Mississippi, and now only about a hundred linger in Florida. The removal was effected in 1842. Florida became a state Mar. 3, 1845, being the 14th of those admitted, and making 27 states in all. Florida seceded from the United States Jan. 10, 1861, and gave her full share of assistance to the rebellion, seizing the United States navy-yard at Pensacola, and the military stations except Key West. The union troops in 1862 recovered St. Augustine, Jacksonville, and Fernandina, but were defeated in a severe engagement at Olustee, where they lost 1200 men. When the rebellion collapsed Florida was an early applicant for re-admission, repealing her secession ordinance in Oct., 1865, repudiating the confederate debt, accepting emancipation, and forming a new constitution which was modified in accordance with the amendments to the federal constitution; and in June, 1868, Florida was re-admitted, since which period material progress has been rapid.

Florida is a long peninsula running s.s.e. between the Atlantic and the gulf of Mexico, with a narrow arm on the n. reaching along the gulf more than half the width of Alabama and, naturally, belonging to that state. This arm was once known as West Florida, the peninsula being East Florida. The s. extremity, Key West, is the utmost s. bound of the union, in 24° 30′ north. The line of the state is irregular, running from the Atlantic along St. Mary's river to Ellicott's Mound in Okefenokee swamp; thence a little n. of w. to Appalachicola river at Chattahoochee; then n. along the river to 31° n.; thence on that parallel to the Perdido river; and down the river to the gulf. The line described was the original division between English territory (Georgia), Spanish

(Florida), and French (Louisiana). The area of Florida is about 60,000 sq.m. (est. 59,268). The peninsula is 375 m. long by 60 to 100 m. wide. The western arm is over 100 m. long by about 50 wide; the entire coast line of Florida is 1150 m., far exceeding that of any other of the states. There are harbors, but only a single bay on the ocean side, bay Biscayne; but on the gulf coast are Florida, Ponce de Leon or White Water, Ostego, Tampa, Wacasassa, Appalachee, Pensacola, Perdido, and several smaller bays, with St. George's sound at Appalachicola. The St. John's river, coming into the Atlantic near the n.e. corner of the state, and for 150 m. above its mouth, having a width of 2 m., runs s. parallel with the ocean through a series of lagoons and small lakes, more than 200 m. to Cypress swamp, and, with its tributaries, affords 1000 m. of steamboat navigation. The other principal rivers beginning at the w. are the Perdido, Escambia, Yellow, Choctahatchee, Appalachicola, St. Marks, Ancilla, Hatchee, Suwanee, Withlacoochee, Caloocahachee, Kissimmee, Miami, and a number of streams from the everglades that drain Okechobee lake, the largest of the many lakes. This lake, n. of the everglades, in the s. part of the state, is said to cover more than 650 sq. miles. Other lakes are Orange, Kissimmee, Cypress, Istokpoga, Ahapopka, Lamona, Alligator, Sante Fe, Washington, Griffin, etc. The everglades, in the wet season, form a lake-like addition to Okechobee lake, and extend over about 3600 sq.m. to the gulf n. of cape Sable. The everglade region is studded with islands in size from a haycock to hundreds of acres, covered with thickets of vine and shrubs, with soil that is very fertile when reclaimed. The everglades occupy nearly the whole of Dade co. In 1840, the co. had a pop. of 412, which dwindled at each census to only 72 in 1870. There are no mountains in Florida, the whole state being of alluvial and diluvial formation, and at no place in the peninsula does the land rise 200 ft. above tide. Good water is to be had almost everywhere by digging three or four yards, and there are many natural springs of large capacity, some impregnated with lime or sulphur. Along the coast from cape Florida (off the center of the everglades) and curving s.w. for about 220 m. is a chain of reefs, rocks, and islands called "keys," terminating with the Tortugas islands. These keys are separated from the mainland by narrow bays and sounds, while s. of the keys and across a navigable strait is a long narrow coral formation known as Florida reef, which is the w. boundary of the gulf stream. Key West is the largest of the keys, having now a considerable city, a government military station, and a brisk trade.

In climate Florida is never cold, and never extremely hot. A record of 20 years shows the following mean for the several months named, at Key West and at St. Augustine :

	Latitude.	Jan.	April.	July.	Oct.	Year.	Rainfall.
Key West....................	24° 36′	66.68	75.58	83.00	78.11	76.51	33.49
St. Augustine................	29. 53	57.03	68.78	80.90	71.88	69.61	47.86

The records at St. Augustine for more than a century show that the average of summer months was 86° and of winter months about 60°. The widest extreme noted ranges from 35° as the lowest, to 95° as the highest. Breezes from the ocean and gulf temper the air, and the nights are almost invariably cool. There is little of spring or autumn; summer lasts two thirds of the year; the rainy season covers the remainder. Florida is considered highly favorable to persons affected with pulmonary complaints, and is largely resorted to by consumptives. The ratio of deaths from consumption in 1870 was smaller in Florida than in any other state except Nevada, although many consumptives go there when quite incurable.

Florida was once well stocked with the larger wild animals, but few of them remain. Brown bears are found, and wolves may haunt the swamps, though they are believed to be extinct. The raccoon, the opossum, the ground-hog (woodchuck), rats, bats, and mice are common, and deer, rabbits, and squirrels are found. The most formidable animal is the alligator, thousands of them inhabiting the rivers, lakes, and everglades. The huge manatee (sea-cow) is occasionally taken, and the genuine crocodile is said to exist. The sounds along the keys are well stocked with turtles, some of enormous size. There are also sharks and enormous cuttle-fish along the coast, and abundance of edible fish in the rivers and lakes. There are ducks, wild turkeys, hawks, eagles, vultures, owls, and of small birds a vast variety of rich plumage, though not noted for song; but this deficiency is fully supplied by the mocking-bird, which in Florida reaches its highest perfection and fills the whole country with harmony.

Live-oak, pine, and hickory trees thrive well. Minerals are scarce, but some precious stones, corals, and calcareous limestone have been discovered. A singular natural feature is known as a "sink," a hollow worn in the limestone by underground streams. In many places there are underground streams large enough to furnish good water-power; and near Tallahassee is a lake, clear and cold, which is fed from subterranean streams.

The light soil of Florida, for the most part sand or loam overlaying clay, varies from uselessness in the pine barrens to extreme fertility in the bottoms and hummocks. Most of the grains of the temperate zone grow in the n. part of Florida; and in other sections tropical fruits thrive. Corn grows in all parts. Long and short staple cotton, sugar-

cane, tobacco, sweet potatoes, rice, hemp, coffee to some extent, peanuts in profusion, rye, oats, and a little wheat, are grown. Favored by its southern position, Florida is able to furnish abundance of garden vegetables to the northern cities from a month to six weeks in advance of the local season, and many steamers are engaged in this trade in early spring. The orange is the most valuable fruit, but lemons, pineapples, figs, olives, citrons, bananas, etc., are grown. Florida oranges are of excellent flavor, and their cultivation is rapidly extending. The yield, usually some hundreds to a tree, is sometimes as high as 10,000 to a tree. About 100 trees are raised to the acre, and very large profits are easily made, but after some years of delay. Peaches and plums do well, but apples and pears do not. Grapes are prolific and excellent. Cocoanuts, plantains, ginger, pepper, cloves, and pimento can be grown. Indigo was formerly cultivated, but has been abandoned. Besides live-oak (valuable for ship timber) and pine, there are splendid flowering magnolias, cypress, dogwood, bay-laurel, satinwood, ligum vitæ, palmetto, mangrove, torchwood, the poisonous manchineel, and the castor oil bean, which is here a perennial tree.

Florida is not a manufacturing state, but there are important exports of turpentine, pitch, rosin, and lumber. There are many cigar manufactories, and salt is made by solar evaporation. The fisheries of Florida are valuable, and the sponge fishery is productive. The commerce of the state is mostly domestic, though Key West, Pensacola, and Fernandina have a considerable West India and Mexican trade.

The principal cities and towns are Jacksonville, Key West, Pensacola, Fernandina, Tallahassee (the capital of the state), and St. Augustine (the oldest white settlement in the United States).

There were published in Florida Jan. 1, 1879, 33 newspapers and magazines: 2 daily, 2 semi-weekly, 28 weekly, and 1 monthly. Florida had in 1878, 87,750 persons of school age (4 to 21 years); enrolled, 31,133; average attendance, 21,787; 970 teachers; school fund, \$243,500; income, \$17,962; expense, \$102,817; value of school property, \$116,984. There were no colleges, but one of agriculture was soon to be founded. The entire receipts for education were \$183,311; \$150,641 from taxation; \$17,962 from apportionment; \$11,108 from private sources; and \$3,600 from the Peabody fund.

There were at the beginning of 1879, open or in progress, 487 m. of railroad· the Florida, or Atlantic and Gulf and West India Transit, from Fernandina to Cedar Keys, 154 m.; the Jacksonville, Pensacola and Mobile, from Lake City to Chattahoochee, 150 m.; the Central, from Jacksonville to Lake City, 59¼ m.; the Atlantic and Gulf, from Live Oak to Dupont, Ga., 48¾ m.; the Pensacola, from Pensacola to Pensacola Junction, Ala., 44 m.; the St. Johns, from Tocio to St. Augustine, 10¼ m.; and two shorter roads.

The constitution adopted in 1868 gives the suffrage "to every male person of 21 years and upwards, of whatever race, color, nationality, or previous condition, who is a citizen of the United States, or who shall have declared his intention to become such, and have resided in Florida one year and in the county six months." After 1880 there is to be an educational qualification for voters. Slavery shall not exist; there are no distinctions on account of color or race; any attempt at secession is forbidden; the governor holds office for four years; other state officers, except the lieut.gov., are appointed by the governor and senate; there are 24 senators chosen for 4 years, and 53 assemblymen for 2 years; legislative sessions are annual and limited to 60 days; members have \$500 a year and 10 cts. per mile for travel. There is a supreme court of a chief-justice and two associates, who hold office during good behavior; also, circuit and county courts, and justices of the peace. Seven circuit court judges are appointed for eight years, and each holds annually two court sessions. The county court judges hold for four years; all judges are appointed by the governor and senate. Florida has two representatives in congress, and has voted six times for president: in 1848 (3 votes), for Taylor and Fillmore; 1852, Pierce and King; 1856, Buchanan and Breckenridge; 1860, Breckenridge and Lane; 1864, no vote; 1868, Grant and Colfax; 1872, Grant and Wilson; 1876, Hayes and Wheeler. The state has furnished no high officers of the federal government. [For latest statistics, see APPENDIX.]

FLORIDA, GULF OF, the name given to the channel between Florida and the Bahamas, traversed by the gulf stream (q.v). From Florida reefs on the s., to Settlemen point, the most northern of the Bahamas in the channel, is 200 m. long; greatest breadth at the southern extremity, 150 miles; at the northern extremity, 65 miles.

FLORIDA BLANCA, Don JOSEFO MONINO, Count of, prime minister under Charles III. of Spain, was b. in 1728, at Murcia, where his father was a notary. Having studied at Salamanca, he gained soon after such distinction that he was appointed Spanish ambassador to Clement XIV. of Rome. In that office, he displayed great ability, especially in the abolition of the order of Jesuits and the election of Pius VI. Grimaldi, Spanish minister of foreign affairs, on being dismissed, was asked by the king to nominate a successor, and accordinnly proposed Monino. Charles followed his advice, created Monino count of Florida Blanca, and intrusted to him, besides, the department of matters of justice and mercy, as well as the superintendence of posts, highways, and public magazines. F. used this extensive authority in introducing post-coaches and good post-roads, in improving the capital, and attending to other important departments

of general police, as likewise in actively promoting the arts and sciences. His effort to confirm the good understanding between Spain and Portugal by a double marriage, which would have secured the Portuguese throne to a Spanish prince, was unsuccessful. His military undertakings also, the attack upon Algiers in 1777, and the siege of Gibraltar in 1782, issued unfortunately. Before the king's death in Oct., 1788, F. presented a defense of his administration, with a request for leave to resign. The defense was accepted, but the request refused. However, under Charles IV., in 1792, F.'s enemies obtained his disgrace. Imprisoned at first in the citadel of Pampeluna, he was afterwards released, and banished to his estates. He appeared again at the meeting of the Cortes in 1808, but died Nov. 20th of the same year.

FLORIDA KEYS, a chain of low islands, or coral reefs, running for more than 200 m. in the form of a crescent around the s. extremity of the mainland of Florida, ending in the rocky reef known as the Dry Tortugas. Among the largest of them are Key Largo, and Key West or Thompson's island, on which the city of Key West is situated. The islands vary in size from a few yards to 25 sq. miles. Some are barren; many are covered with a dense growth of trees. Their flora is West Indian rather than continental. Fort Jefferson, a government military station, is on the Dry Tortugas. The whole pop. of these islands in 1870 was 5,558.

FLORIDEÆ. See CERAMIACEÆ.

FLORIDIA, a t. of Sicily, in the province of Syracuse, 7 m. w.n.w. from the city of Syracuse. It stands in a wide plain, amidst vineyards, olive-groves, and corn-fields. The houses are mostly low and small. Pop. 8,500.

FLORID STYLE, in music, an epithet applied by modern musicians to any movement, or passage, composed in a brilliant, fanciful, rich, and embellished style.

FLORIN was the name of a gold coin first struck in Florence (q.v.) in the 13th century. It was the size of a ducat, and had on one side a lily, and on the other the head of John the Baptist. Some derive the name from the city, and others from the flower. These coins were soon imitated all over Europe. It was out of them that the German gold guldens of the middle ages and the modern guldens arose. These last are still marked by the letters *Fl.* The gulden or florin is the unit of account in Austria, and has a value of about 2*s.* Till 1875, a F. or gulden of 1*s.* 8*d.* was the unit in the south German states. The Dutch F. or guilder is also worth 1*s.* 8*d.* The English 2*s.* piece is called florin.

FLORIN'IANS, a Gnostic sect, of the 2d c., so called from a Roman priest, Florinus, who, with his fellow-presbyter, Blastus, introduced doctrines resembling those of Valentinus, into Rome in the pontificate of Eleutherius (176), and was excluded from communion by that pontiff. See GNOSTICISM, VALENTINIANS.

FLORISTS' FLOWERS are those kinds of flowers which have been cultivated with peculiar care, and of which, consequently, there exist numerous varieties, differing very much in appearance from each other and from the original flower. Such are tulips, hyacinths, roses, auriculas, carnations, anemones, ranunculuses, dahlias, etc. The special cultivation of particular flowers was first prosecuted to a remarkable degree in Europe by the Dutch in the beginning of the 17th c., and from the Netherlands a passion for it extended to other countries, particularly to England and Scotland, when the religious persecutions drove many refugees to the British shores; and to this day it prevails most of all where the branches of manufacture introduced by the refugees are carried on. In the little gardens of operatives in some of the manufacturing towns may be seen many of the finest tulips and carnations in Britain. It is still, however, in Holland, and particularly at Haarlem, that this branch of gardening is carried on to the greatest extent, and it is from that quarter that the market of the world is chiefly supplied with bulbs, seeds, etc. Between Alemsei and Leyden are more than twenty acres appropriated to hyacinths alone, which succeed best in a loose sandy soil. The cultivation of roses at Noordwyll, in South Holland, is carried on in considerable fields situated in the *dunes*, and affords support to many families. Berlin has of late years become the seat of a flower-trade, which partially rivals that of Holland. Some flowers, as dahlias and hollyhocks, are produced in greatest perfection by British cultivators. The Chinese have had their florists' flowers, camellias, hydrangeas, tree peonies, etc., from time immemorial.

In the years 1636 and 1637, an extraordinary flower-mania prevailed in Holland, chiefly with reference to tulips, in which men speculated as we have recently seen them do in railway shares. Bulbs were sold for enormous sums. For a single *semper Augustus* (a tulip), 13,000 florins were once paid, and for three such together, 30,000 florins. The ownership of a bulb was often divided into shares. Men sold bulbs, which they did not possess, on condition of delivering them to the buyers within a stipulated time; and of some varieties, far more bulbs were sold than actually existed. But these extravagances soon ceased, although not till they had involved many persons in ruin.—It was not till about the year 1776 that the real flower-trade of Holland reached its greatest importance; from which time it has rather declined. New varieties of tulips and hyacinths are sometimes marked in the Haarlem catalogues at prices from 25 to 150 florins.

FLO'RUS, generally, but on insufficient evidence, called L. Annæus F., was a Roman historian who flourished in the reign of Trajan or Hadrian. Of his life we know absolutely nothing. He wrote an epitome of Roman history (*Epitome de Gestis Romanorum*), from the foundation of the city to the time of Augustus. This work, which is still extant, is carefully and intelligently composed, but is disfigured by an inflated and metaphorical style. Since the *editio princeps*—if, indeed, it be such—printed at the Sorbonne in 1471, F.'s epitome has been published times without number. The best modern editions are those of Jahn (Leip. 1852) and Halm (1854).

FLOSS SILK, that which is broken in the reeling. It is afterwards macerated in water, pressed, dried, and spun into yarn, which is useful in making the coarser kind of silk or mixed goods.

FLOTANT (Fr.), used in heraldry to express that the object is flying in the air, as a banner-flotant.

FLOTOW, FRIEDRICH VON, a living operatic composer of Germany. Born at Tentendorf, in Mecklenburg, in 1812, he was at first intended for the diplomatic profession; but finding a musical career more congenial to him, he took lessons in composition from Reicha, in Paris. His earlier operas were refused by the managers of the Paris theaters; and his reputation was first established by his music to *Le Naufrage de la Méduse*, produced in 1839 at the Théâtre de la Renaissance, which was a great success. Since then, he has composed various light operas, including *Le Forestier*, *L'Esclave de Camoëns*, *Alessandro Stradella*, *L'Ame en Peine*, *Martha*, *Rübezahl*, and *Zilda*, which have attained considerable popularity in France and in Germany, and are characterized by easy and lively dramatic action, readiness of invention, pleasing melody, and graceful instrumentation. *Martha* has, since it was produced in London, become a great favorite in this country. F. was, in 1854, appointed intendant of the theater at Schwerin, and was elected a corresponding member of the French institute in 1864.

FLOTSAM. Wreck, in the legal acceptation of the word, is goods which, having been scattered by a shipwreck, have floated to land. From goods in the position of wreck are distinguished those known to the law of England by the uncouth expressions *flotsam*, *jetsam*, and *ligan*. The first is where the goods continue floating on the surface of the waves; the second is where, being cast into the sea, they sink and remain under water; the third is where they are sunk in the sea, but are tied to a cork, bladder, or buoy, in order that they may be recovered. If no owner appears to claim them, goods in these various positions go to the crown, so that by a royal grant to a man of *wrecks*, things *flotsam*, *jetsam*, or *ligan* will not pass. See JETSAM, and JETTISON, an important term in the law-merchant, from which jetsam must be carefully distinguished.

FLÖTZ (Ger. level), the name given by Werner to the secondary rocks of Lehmann, because, in the district in which he examined them, they were horizontal. He arranged the rocks which form the solid crust of the earth into four classes. 1. The primitive beds without organic remains, such as granite and gneiss; 2. The transition strata, which, from their more or less metamorphic condition, were related to the primitive rocks on the one side, and from their few contained organisms, to the F. on the other; 3. The F. containing all the sedimentary rocks, from the coal-measures up to and including the chalk; and 4. The newer strata, which he called the "overflowed land" or alluvium. When the followers of Werner found that the horizontal position of the F. was a local accident, they abandoned the term, and restored Lehmann's title of secondary.

FLOUNDER, *Platessa*, a genus of fishes, of the flat-fish family (*pleuronectidæ*), having one row of cutting teeth in each jaw, and generally pavement-like teeth on the pharynx; the dorsal and anal fins extending nearly the whole length of the body, the dorsal not coming further forward than the center of the upper eye; the tail-fin distinctly separated both from the dorsal and the anal. To this genus belong the plaice, flounder, dab, etc., of the British shores. The species generally known as the F. (*P. flesus*), is very common, not only on the British shores, but on those of most parts of Europe. Its Swedish name is *flundra*. Its Scottish name is *fleuk* or *fluke*, a name which, with additions, is extended to many other kinds of flat-fish. The F. is often a foot or more in length. Its greatest breadth, without the fins, is about one third of the whole length, rather less than that of the plaice. It is easily distinguished from the plaice by a row of small tubercles on each side of the lateral line. The color varies according to the ground from which the fish is taken. The F. is found chiefly in rather shallow water, with sandy or muddy bottom, and equally in the most perfectly salt water and in the brackish water of estuaries. It ascends still rivers into perfectly fresh water, and may be kept in fresh-water ponds. It lives long out of water, and is easily transferred to ponds.—The F., like the other fishes of this genus, generally swims on the left side, and has the eyes on the right side; but reversed specimens are of frequent occurrence.

FLOUR is a popular name gived to the finer portions of meal or pulverized grain. Thus, *flour*, or *wheat-flour*, is the fine part of ground wheat; *pea-flour*, of pease, etc. See BREAD.

FLOUR. See MILL, *ante*.

FLOUR, St., a small t. of France, in the department of Cantal, is finely situated on a steep basaltic plateau at an elevation of 3,000 ft., 34 m. e.n.e. of Aurillac. It is entirely built of lava and basalt. Its streets are narrow, and its houses in general have a miserable, dark, and dirty appearance. The principal building is the cathedral. A suburb lies at the foot of the rock, and communicates with the town by a winding road cut in the rock. F. has manufactures of hollow ironware, cloth, and table-linen. Pop. '76, 4,848.

FLOURENS, Gustave, 1838–71; a French socialist. In 1863, he gave at the college of France a series of lectures on the history of mankind. His theories as to the manifold origin of the human race gave offense to the clergy, and he was precluded from delivering a second course. He then repaired to Brussels, where he published his lectures under the title of *Histoire de l'Homme;* he next visited Constantinople and Athens, took part in the Cretan insurrection of 1866, spent some time in Italy, where an article of his in the *Popolo d'Italia* caused his arrest and imprisonment; and finally, having returned to France, he nearly lost his life in a duel with Paul de Cassagnac, editor of the *Pays.* In Paris he devoted his pen to the cause of republicanism, and at length, having failed in an attempt to organize a revolution at Belleville (Feb. 7, 1870), found himself compelled to flee from France. Returning to Paris on the downfall of Napoleon, he soon placed himself at the head of a body of 500 tirailleurs. On account of his insurrectionary proceedings he was taken prisoner at Creteil, near Vincennes, by the provincial government, and confined at Mazas, Dec. 7, 1870, but was released by his men on the night of Jan. 21–2. Mar. 18, he joined the communists. As colonel of the 19th and 20th arrondissements, he took part in an attack on Versailles, and early in the morning of the 3d of April was killed in a hand-to-hand conflict at Rueil, near Malmaison.

FLOURENS, Marie Jean Pierre, a celebrated French physiologist, who was b. in 1794, at Maureilhan, Hérault. After having obtained his degree of doctor of medicine at Montpellier, at the early age of 19, he proceeded to Paris, where he soon became acquainted with the Cuviers, Geoffroy St. Hilaire, and other eminent naturalists. For more than 40 years, F. was a voluminous writer on human and comparative anatomy and physiology, on natural history, and on various special departments of the history of the natural and physical sciences. Among his most important works we may mention his *Recherches Expérimentales sur les Propriétés et les Fonctions du Système Nerveux dans les Animaux Vertèbres* (1824); with a supplementary volume, entitled *Expériences sur le Système Nerveux* (1825); *Recherches sur le Développement des Os et des Dents* (1842); *Anatomie Générale de la Peau et des Membranes Muqueuses* (1843)—a work tending to demonstrate the unity of the human race, by showing that there are no essential differences between the structure of the skin in the negro and the European—and his *Théorie Expérimentale de la Formation des Os* (1847), perhaps the most celebrated of his works. Among his smaller and popular works, are his *Analyse Raisonnée des Travaux de Georges Cuvier* (1841); *Buffon, Histoire de ses Idées et de ses Travaux* (1844); *De l'Instinct et de l'Intelligence des Animaux* (1841); *Examen de la Phrénologie* (1842); *Histoire de la Découverte de la Circulation du Sang* (1854); *De la Longévité Humaine, et de la Quantité de Vie sur le Globe* (1854); and his *Eloges Historiques*—a beautifully written series of scientific biographies.

As early as 1821, F. delivered a course of lectures on "The Physiological Theory of Sensations," and presented some of his first scientific contributions to the academy of sciences, into which body he was admitted as a member in 1828. About this date he was appointed assistant to Cuvier; and in 1832, he succeeded to the full duties of the professorship of natural history in the Jardin du Roi. In 1833, he succeeded Dulong as perpetual secretary of the academy of sciences—an office which he continued to discharge until his death; and in 1840, the French academy elected him a member. He was made a peer of France by Louis Philippe in 1846, and was appointed professor in the collége de France in 1855. He died at Montgeron, near Paris, Dec. 6, 1867.

FLOUR MANUFACTURE, New Process of, is a way of making flour so as to retain that portion of the wheat which by the old methods is eliminated in the form of "middlings." This part of the grain being very nutritious, its retention enhances the value of the new flour and increases its quantity by over 8 per cent. The "new process" has been extensively introduced in the great flour-mills of this country. The grinding is done at a comparatively low rate of speed, and the result is obtained by bolting-cloths of a peculiar sort. It is unfortunate that the "new process" has thus far been successfully applied only to spring wheat.

FLOUR, SELF-RAISING, is flour in which has been incorporated, by the process of sifting, a yeast-powder, compressed in proper chemical proportions, of bicarbonate of soda and tartaric acid, or its compound with potassa, the bitartrate of potassa, or cream-tartar. Flour thus prepared, after receiving the proper quantity of salt, and being mixed with a due proportion of water or milk, yields carbonic acid gas, under the influence of which the dough becomes porous, when it is ready to be put into the oven and baked. The yeast-powder is sold in bottles or in cans, in quantities suited to family use. As tartaric acid yields no nutritive property, the use of acid phosphate of lime in the form of powder has been introduced in its stead, upon the theory, suggested by prof. Horsford, that it restores to the flour the phosphates of the wheat which were removed with the bran. Liebig commends this process. The great convenience of this

way of making bread is its chief recommendation; the dough may be baked at once, whereas the process of fermentation consumes several hours. As the constituents of the yeast-powder do not act upon each other in the absence of water, it may be mixed in the flour beforehand, and flour thus prepared is extensively sold in the United States under the name of "self-raising flour." The same process may be applied to a mixture of rye and wheat flour, and also to oat or corn meal.

FLOWER, or BLOSSOM, that part of a phanerogamous plant in which the organs of reproduction (*stamens* and *pistils*) are situated, and which consists essentially of a single group of these, generally surrounded by *floral envelopes* (the *calyx* and *corolla*). Both the organs of reproduction and the floral envelopes are metamorphosed leaves, and arise in successive whorls from a much shortened axis, called the *thalamus* (Gr., a nuptial-bed), or *torus* (Lat., a couch). Flowers are sometimes closely attached to the stem or branch from which they grow, and are then said to be *sessile* (Lat., sitting); but sometimes there intervenes a *flower-stalk* or *peduncle*, either simple or branched. The whole assemblage of flowers of a plant is called its *inflorescence* (q.v.), and the different kinds of inflorescence, or modes in which the flowers are produced and grouped, are often as characteristic as the diversities in the flowers themselves, although the latter are in general more important with reference to botanical affinities.

In the very large natural order *compositæ*, many small flowers are congregated on a common *receptacle*, and surrounded with *bracts* in the form of an *involucre*, as a single flower is surrounded by its calyx. The *head of flowers* is in this case popularly called a flower; and the individual flowers of which it is composed are by botanists styled *florets*. This term is also applied to the individual flowers in the *spikelets* of the grasses (q.v.), of which the *glumes* are a common involucre.

The order of the whorls in flowers is invariable: the calyx (q.v.) is always exterior to the corolla (q.v.); within the corolla are the *stamens* (q.v.), or male organs of reproduction; and in the center of all is the *pistil* (q.v.), the female organ of reproduction. An outer calyx, or whorl of metamorphosed leaves, exterior to the calyx, and usually smaller, is found in some flowers, as mallows, and is called the *epicalyx*. Within the corolla, there is sometimes an additional or supplementary corolla, called the *corona* (q.v.), *coronet*, or *crown*. When the calyx and corolla are not easily distinguishable, the term *perianth* (q.v.), or *perigone*, is employed, as in the lily, crocus, iris, and the greater number of endogenous plants, although even in these there are really two whorls closely united. In some flowers, there are several whorls of leaves forming one or each of the floral envelopes; and in like manner, some have several whorls of stamens, and sometimes there are several whorls of the carpels which form the pistil. In some flowers, certain whorls are entirely wanting; and thus not a few exogenous plants are destitute of the corolla, which is sometimes the case with plants—exceptional *apetalous* species—very nearly allied to others that have it. It is by a similar abortion of a whorl that flowers become unisexual. Both stamens and pistils are generally present in the same flower, which is called a *hermaphrodite* or *perfect* flower; but many flowers contain only the male organs of reproduction, and many contain only the female organs, and such flowers are described as *unisexual, diclinous* (q.v.), or *imperfect;* and respectively as *male* or *staminiferous*, and *female* or *pistilliferous* flowers. Male flowers are also called *barren* or *sterile*, and female flowers *fertile*, although their fertility depends on the communication of pollen from the staminiferous flowers. When both male and female flowers are produced on one plant, the species is said to be *monœcious* (Gr., having one house); but when they are on separate plants, it is *diœcious* (Gr., having twe houses); those which produce male, female, and hermaphrodite flowers are called *polygamous*. Sometimes both stamens and pistils are wanting, and the flower is then said to be *neuter* or *empty*, as in the case of the florets of the ray in many composite flowers. Sometimes, on the contrary, both calyx and corolla are wanting, and then the flower is said to be *naked* or *achlamydeous* (Gr., without covering), as flowers having only one floral envelope are called *monochlamydeous*, and flowers having both calyx and corolla are called *dichlamydeous*. Achlamydeous flowers are often grouped in some peculiar manner, and protected by bracts or by a spathe.

Flowers are always regular in their rudimental state—whorls of elevated points or *papillæ;* some of these, however, are not unfrequently abortive, whilst more frequently, some acquire a greater development than others of the same whorl, making the whorl and the flower *irregular;* and greater varieties of form are common in the metamorphosed leaves which compose the flower than in true leaves themselves. The *internodes*, or portions of the axis between the whorls, are sometimes also peculiarly developed into *disk* (q.v.), *gynophore*, etc. The different whorls often differ in their *æstivation* (q.v.). But a beautiful symmetry may generally be traced in the arrangement of the parts of flowers, the whorls consisting of the same number of parts, and the parts of each whorl being placed opposite to the spaces of the whorl exterior to it; and this symmetrical plan of the flower remains manifest even when there is abortion or extraordinary development of particular parts. The number of parts in the pistil is, however, often smaller than in the exterior whorls; and sometimes particular parts appear to be divided, and so apparently multiplied, as the long stamens of the *cruciferæ*, each pair of which is to be

regarded as one stamen split into two, and has its place accordingly among the parts of the flower.

The development of flowers in most cases follows the complete formation of the stem-leaves, more rarely precedes or accompanies it. The unfolding of the parts of a flower is called its *flowering* or *blossoming*, and when their functions are performed, it fades; the floral envelopes, the stamens, and even the styles, sometimes falling off early, and some of them sometimes remaining in a withered state until the ripening of the fruit; the calyx not unfrequently undergoing such modifications as to convert it into a part of the fruit itself.

In the greater number of plants, flowering takes place, during the flowering season, indiscriminately, at all hours of the day; and the flowers once opened, remain open, even during night, till they fade. In many plants, however, a *sleep of flowers* takes place; they open and close with the returns of day and night. Thus, *sunflowers* open in the morning, and close at evening; whilst there are other flowers which open in the evening, and close in the morning. Others also open and close at certain hours of the day; thus the flowers of the common purslane open about 11 o'clock A.M., and close soon after midday; *anthericum pomeridianum* opens its flowers about 2 P.M., and closes them before night; the large fragrant blossoms of *cereus grandiflorus* open between 7 and 8 P.M., and its sleep commences soon after midnight. In a few plants, the sleeping and waking of the flowers are regulated by the conditions of the weather. The waking and sleeping of flowers either continues for several days in succession, as in some species of *mesembryanthemum;* or the brief life of the flower ends when it first sleeps, as in the tiger-flower.

The odors of flowers, extremely various, often delightful, and sometimes very offensive, are in some cases equally powerful as long as the flower is open; in others, they vary in strength at different times of the day. Some flowers, as those of *hesperis tristis* and *pelargonium triste*, although remaining open during the day, diffuse their fragrance only when night comes on. The oriental hyacinth, so commonly cultivated in windows, is at all times perceptibly fragrant, but fills the atmosphere of the apartment with its perfume about 11 o'clock at night.

The colors of the different parts of flowers, the variety and beauty of which render many of them so attractive, generally remain unchanged, but sometimes undergo changes during the life of the flower. The flowers of *myosotis versicolor*—a small species of forget-me-not, very common as a weed in gardens—are sulphur-yellow when they first open, and afterwards change to blue. The petals of *cheiranthus mutabilis*, when they first expand, are yellow, and afterwards pass to orange, red, and finally purple. In *hydrangea hortensis*, familiar as a window-plant, the flowers are at first green, then rose-color, purplish red intermixed with green, and finally, when about to fade, they are of a sickly green. Some flowers undergo remarkable changes of color during the day, as those of the common pink *phlox*, which, early in the morning, are light blue, and become bright pink as the day advances; and those of *hibiscus variabilis*, which are white in the morning, pink at noon, and bright red at sunset.

The colors and odors of flowers are subjects in the investigation of which physiologists have not yet been able to go far. The chemical products on which they immediately depend are partially known; but how the chemical changes are wrought, and what various purposes they all serve as to the plant itself, can scarcely be said to have even begun to be ascertained. Both colors and odors are more or less owing to the action of the sun's rays. They are also sometimes modified by soil; and diversities of color have been obtained in cultivated flowers by changing the soil in which they grow.

A few flowers are edible, although none are of any importance on this account. Some, or parts of them, are used in dying; but notwithstanding the beauty and variety of the colors of flowers, a very small proportion of vegetable dye-stuffs is obtained from them; and a similar remark is applicable to their medicinal use. For dyeing and painting, the colors of flowers can seldom be obtained in considerable quantity, except at too great expense, and seldom of brilliancy at all corresponding with that which they exhibit in the flower itself. They are also in general fixed with great difficulty, some yellow colors being the only notable exceptions

Flowers being subservient to the reproduction of the species, are, in all not unfavorable circumstances, followed by fruit (q.v). This, of course, in monœcious and diœcious plants, is the case only with the female flowers, the male flowers soon withering away when they have dispersed their pollen. See FECUNDATION and STAMEN. But even after the fecundation of the germen, and when, in the language of gardeners, the fruit is *set*, unfavorable circumstances—such as excessive heat or cold, drought or moisture, want of due nutriment to the plant, or through excessive number of fruits set at once—to the individual fruit itself, often cause it to fall off early, long before it has attained its full size. See FRUIT.

FLOWER-DE-LUCE. SEE IRIS.

FLOWER-POTS are generally made of burnt clay, unglazed, tapering a little towards the bottom, and having the bottom perforated with one or more holes. Those of smallest size (*thumb-pots*) are only about 2 in. deep, and are used chiefly for seedlings to be soon again transplanted. For plants which require a pot of more than 12 in.

deep and 18 in. wide, wooden boxes or tubs are generally provided. The flower-pot is usually placed in a saucer of the same material, when used in apartments or on the shelves of a green-house; but when plants growing in flower-pots are placed in the garden, the saucer is dispensed with. For ornamental use, flower-pots are sometimes glazed, or made in the shape of vases, etc.—In filling flower-pots, small stones or bits of broken pottery are placed in the bottom, to prevent water from lodging there, and *souring* the soil in which the plant is to grow. The roots of plants growing in pots are generally examined once or twice a year, by turning them out of the pot with the whole ball of earth attached, when the roots, which have often become matted round the outside of the ball of earth, are pruned, and the plant is either restored to the same pot or transferred to a larger one. The change of soil made at this time is, according to circumstances, either complete or partial.

FLOWERS, Artificial. This elegant branch of manufacture, though not usually ranked among the fine arts, may be fairly regarded as holding an intermediate place between them and the mechanical arts. The Italians were the first to bring it to a high state of perfection, and it is now successfully carried out both in England and France. The value of artificial flowers annually exported from France exceeds £40,000.

The materials used are very various. Feathers have long been used by the South American Indians. In Italy, the cocoons of silk-worms are dyed, and extensively used. Beautiful imitations of flowers are made from shells, either in their natural colors or tinted. Paper, ribbons, velvet, thin laminæ of whalebone, etc., are also used. The materials of which the artificial flowers commonly in use are made are French cambric, Scotch cambric, jaconet, and fine calico, besides muslin, crape, and gauze for particular flowers, and satin and velvet for thick petals, etc. Wax-flower-making is quite a distinct branch, and those who follow it claim with justice the title of artist. It will be treated under the head of Wax-flowers.

The petals and sepals of the flowers, as well as the leaves of the plant, are stamped out by punches, or "irons," as they are technically termed. A large stock of these irons is necessary, as special forms and sizes are required for each flower. The next process in shaping is that of "goffering," or "gauffering," by means of which the hollow form is given to petals, and the midrib and veins of leaves imitated. For hollowing petals, the goffering iron is simply a polished iron ball mounted on an iron wire in a handle. It is slightly warmed, and the petal is placed on a cushion, and the iron pressed against it. A variety of other forms of goffering-irons are used, such as prismatic rods, bent wires, etc. The venation of leaves is effected by dies made of iron or copper, which are nevertheless called goffering-irons.

The tinting of petals of the best flowers requires some amount of delicacy and skill. In nature, however, the tint of each petal of a flower is rarely uniform; and the best artificial flowers represent the natural variations with great accuracy. The petals of a rose, for example, are dyed by holding each separately by pincers, and then dipping it in a bath of carmine, and afterwards into pure water, to give delicacy of tint; but as the color is usually deepest in the center, a little more dye is added there while the petal is still moist, and this diffuses itself outwards in diminishing intensity. The whiteness at the insertion of the petal is produced by touching that part with pure water after the rest is dyed

Leaves are cut and stamped in like manner from green taffeta, cambric, calico, etc. The glossy upper surface is represented by coating the taffeta, etc., from which they are stamped, with gum-arabic; and the soft tone of the under side is obtained by means of starch colored to the requisite shade, and brushed on when of the right consistence to dry with the proper effect. A velvety texture is given by dusting the powdered nap of cloth, which has been previously dyed of the required color, over the gummed leaf, the gum having been allowed to partly dry till it has become "taccy." The superfluous portion of nap is then shaken off. Buds are made of taffeta, tinted, and stiffened, and stuffed with cotton. Stamens are made of short pieces of sewing silk stiffened with gelatine, and when dry, the ends are moistened with gum, and dipped in flour, colored yellow, to represent the pollen. Fine wire is sometimes used for the filament of the stamen.

The flower is built up from the center; the pistil and stamens are tied in a bunch to a piece of wire; the petals are arranged in order, and pasted; then the sepals of the calyx are pasted outside of these, and further secured by winding fine thread or silk round the lower parts. Other wires are inclosed with this thread, and form the stalk, which is bound round with green tissue paper; and at proper intervals the leaves are inserted by means of fine wires, to which they are bound, the ends of these wires being bound in and incorporated with the stalk, and concealed by the green paper.

Besides the flowers copied from nature, there is a considerable demand for what are called "fancy flowers," most of which are invented by the manufacturer to use up waste and spoiled fragments originally designed for better purposes.

Flowers suitable for mourning are prepared by coating leaves, flowers, etc., with strong gum, and then dusting upon them powdered galena. This substance, a sulphuret of lead, is formed naturally in lustrous cubic crystals of a dark-gray color, and however finely it is powdered, the fragments still tend to retain the same shape and surface, and

thus present a number of flat glittering facets. It is used in like manner for cheap jewelry.

FLOWERS, in chemistry, is a term originally given by the alchemists to the sublimates which rose or appeared to grow from certain bodies capable of undergoing volatilization when subjected to heat. Thus, *flowers of antimony, flowers of arsenic, flowers of benjamin or benzoin, flowers of sulphur, flowers of zinc*, etc.

FLOWERS, LANGUAGE OF, or FLORIGRAPHY, is supposed to have been used among the earliest nations; but the Greeks are the first users of whom we have any trustworthy records. They carried it to a very high degree, using flowers as types of everything interesting, public as well as private. Shakespeare confides to us that "fairies use flowers for their charactery;" while other poets tell us that the flowers themselves speak. In earlier times florigraphy was much cultivated by the nations of continental Europe; but after the decline of the power of Rome, little attention was given to it. Its study was revived, however, during the middle ages, when chivalry became pre-eminent; and it received great development at the hands of the Roman church. The variety of the flowers that adorned the altar enabled the worshiper to distinguish between feasting and fasting ceremonies. Flowers have had an important part in all mythologies. Oak was the patriot's crown, bay the poet's, and the myrtle the crown for beauty. The olive was the token of peace as the ivy was the emblem of Bacchus. The significance of many flowers is derived from their properties. The amaranth has a very poetical meaning, being called "the never-fading" by the Greeks, because of its duration. It has been selected to typify immortality; and is referred to in Longfellow's poem "The Two Angels." The daisy has received much attention from the poets: Shakespeare says "its white investments figure innocence." The rose—by universal suffrage made the queen of the flowers—has a symbolism varying with its color; a single red rose signifies "I love you;" the small white bridal rose typifies happy love; and the moss rose-bud, a confession of love. The varied and magnificent flora of America offers a vocabulary replete with brilliant and original tokens. Flowers are also the emblems of several European countries, such as the *fleur-de-lis* of France, the thistle of Scotland, and the shamrock of Ireland. The following are some well-known flowers, with their symbolism as used in poetry:

Anemone—Frailty, Anticipation.
Apple Blossom—Preference.
Buttercups—Riches.
Calla—Magnificent beauty.
Candytuft—Indifference.
Cowslip—Youthful beauty.
Daffodil—Unrequited love.
Dandelion—Coquetry.
Forget-me-not—True love.
Fox-glove—Insincerity.
Geranium—Deceit.
Gentian—Virgin pride.
Golden-rod—Encouragement.
Heliotrope—Devotion.
Honeysuckle—Fidelity.
Hyacinth—Sorrow.
Lilac—Fastidiousness.
Marigold—Contempt.
Lily—Majesty, Purity.
Narcissus—Self-love.
Pansy—Thoughts.
Poppy—Oblivion.
Snow-drop—Friend in need.
Sweet William—Gallantry.
White Violet—Modesty.

FLOX ÆRIS is a term applied to the suboxide or red oxide of copper.

FLOY, JAMES, D.D., 1806-63; b. N. Y.; educated at Columbia college and in Europe. He was a Methodist pastor in New York, Connecticut, and elsewhere. In 1848, he was put on the committee to revise the denominational hymn-book, and much of the improvement in the new version is due to him. In 1854, he was presiding elder of the New York district of the N. Y. E. conference; and in 1856, editor of the *National Magazine* and corresponding secretary of the tract society. He was an early and able opponent of slavery.

FLOYD, a co. in n.w. Georgia, on the Alabama border, drained by the Coosa river, and intersected by the Selma, Rome, and Dalton railroad; 540 sq.m.; pop. 70, 17,230—5,753 colored. The surface is hilly and in some parts mountainous, and much of it is covered with forests. Cotton, corn, wheat, and pork are the chief products. Iron and plumbago are found. Co. seat, Rome.

FLOYD, a co. in s. Indiana, on the Ohio river, intersected by the Louisville, New Albany, and Chicago railroad; 148 sq.m.; pop. '70, 23,300. The surface is hilly, and the soil fertile, producing the usual cereals. Limestone, slate, and timber are plentiful. Co. seat, New Albany.

FLOYD, a co. in n.n.e. Iowa, on Cedar and Shell Rock rivers; intersected by the Milwaukee and St. Paul, the Burlington, Cedar Rapids, and Northern railroads, and the Cedar Falls and Minnesota branch of the Illinois Central railroad; 550 sq.m.; pop. '75, 13,100. The surface is chiefly prairie, with considerable timber. Soil fertile, producing wheat, corn, etc. Co. seat, Charles City.

FLOYD, a co. in e. Kentucky, on Big Sandy river; 520 sq.m.; pop. '70, 7,877—171 colored. The surface is hilly, and mostly pasture land. Corn and pork are the staple products, and there are valuable beds of coal. Co. seat, Prestonburg.

FLOYD, a co. in s.w. Virginia, bounded on the s.e. by the Blue Ridge; 270 sq.m.; pop. '70, 9,824—997 colored. The surface is hilly, and mostly covered with forests. Corn, wheat, oats, and butter are the principal products. Co. seat, Floyd Court House.

FLOYD, JOHN BUCHANAN, 1805–63; b. Va.; son of gov. John; graduated at South Carolina college, and practiced law in Arkansas; afterwards in Virginia, where he was a member of the legislature. In 1849, he was chosen governor. He was again member of the legislature, and a strong advocate of the nomination of Buchanan for president. When Buchanan became president he made Floyd secretary of war. At the commencement of the rebellion Floyd resigned. He had done his utmost while secretary to dispose of the regular army so as to favor the projected rebellion. He scattered the forces to remote stations, and transferred a great supply of arms from the northern to the southern states. Besides this he abstracted $870,000 in government bonds, for which he was indicted. In the confederate service he was a brig.gen.; was defeated at Gauley bridge, losing his baggage, ammunition, and camp equipage. At Fort Donelson he was besieged by Grant, but the night before the surrender he, with gen. Pillow and 3,000 men, made his escape into Tennessee. With this inglorious episode his military career ended.

FLOYD, WILLIAM, 1734–1821; b. N. Y.; one of the signers of the declaration of independence, and a gen. during the revolution. He was a delegate to the first continental congress, and while in attendance at Philadelphia, an English fleet arrived off the entrance of Long Island sound, with the purpose of invading and ravaging the island. Floyd returned, gathered the militia of Suffolk co., and made so strong a show of resistance that the British abandoned their purpose. He was eight years in the congress. In 1777, he was elected to the New York state senate, and was also a member of the first congress under the federal constitution. As one of the presidential electors in 1801, he voted for Jefferson, and in the same year was chosen to the New York constitutional convention.

FLUDD, ROBERT, 1574–1637; an English physician and mystic philosopher. After studying at Oxford, he traveled for several years in Europe, where he became fascinated with the writings of Paracelsus. Fludd believed in two universal principles, the northern or condensing, and the southern or rarefying power, and in the existence of four elemental spirits, corresponding to fire, air, earth, and water. The chief principle of his philosophy was that man was a representation in miniature of the universe, and he endeavored to trace the analogy between what he called the microcosm and the macrocosm. Absurd as such propositions now seem, they at that time provoked serious refutation from Kepler, Gassendi, and Mersenne. De Quincey considers Fludd to have been the immediate father of freemasonry, as Andrea was its remote father.

FLUE. See CHIMNEY.

FLUE, NIKOLAUS VON DER, SAINT, 1417–87; b. Switzerland, of a good family. He was well educated, was a soldier of distinction, and for nearly 20 years a judge and counselor of state. In 1467, he abandoned his family and became a hermit in the Alps, going bareheaded and barefooted, and living solely upon charity. Ten years later he began his career as a preacher. In 1481, he visited the diet at Sanz and was instrumental in preserving the confederation. He was made a saint in 1669.

FLUENTS and FLUXIONS. See FLUXIONS, *ante.*

FLÜGEL, GUSTAV LEBRECHT, 1802–70; a German orientalist, was educated in theology at Leipsic, and studied oriental languages in Vienna and Paris. He published an edition of the *Koran,* and among his later works are the *Concordantiæ Corani Arabicea* and *Die arabischen, türkischen und persischen Handschreften.*

FLÜGEL, JOHANN GOTTFRIED, 1788–1855; a German lexicographer. He emigrated to America in 1810, and made a special study of the English language. Returning to Germany in 1819, he became professor of English in the university of Leipsic. In 1838, he became American consul, and in later years representative and correspondent of many literary and scientific institutions of the United States. His fame rests chiefly on his *English-German and German-English Dictionary.*

FLUID. The mathematical definition of a fluid is, that it is a collection of material particles which can be moved among each other by an indefinitely small force. No fluid in nature strictly fulfills this definition, though very many do so sufficiently nearly to make the conclusions founded on the definition practically correct. Fluids are distinguished into elastic and inelastic—the former being those the volume of which is diminished by pressure, and increases when pressure is removed; the latter being those which have not this property, e.g., water and all those fluids termed liquids (q.v.). Elastic fluids are also spoken of as compressible; and inelastic as incompressible—which, strictly speaking, no known fluid is, although all ordinary liquids are sufficiently nearly so to enable us to regard them as such without sensible error. See VAPOR, ELASTICITY and HEAT, COHESION and CAPILLARY ACTION.

FLUKE, the pointed triangular termination to each arm of an anchor (q.v.).

FLUKE, or FLUKE-WORM, *Distoma hepaticum,* an entozoon common in the liver and biliary ducts of ruminants, particularly of sheep, in which it produces the disease called *rot,* often causing great mortality in flocks during wet seasons and on ill-drained lands.

It receives its common name from its resemblance in form to the flounder, of which *fluke* is a Scotch and old English name. For a similar reason, it is sometimes called *plaice*. It is a trematode (q.v.) worm, higher in organization than the cestoid worms, but not so high as the *cœlelmintha*. It is generally not quite an inch in length, often much less, but sometimes more; of an oval form, its breadth about half its length; flat, in color not very different from the liver in which it exists; it has no eyes nor other known organs of special sense; it is hermaphrodite, and the organs of reproduction occupy great part of its body, the ovaries being ranged along the margin; its anterior extremity is furnished with a sucker, and another is situated at a small distance on the ventral surface, whence the name *distoma* (Gr. two-mouthed), but the terminal sucker alone is perforated, and serves as a mouth, by which bile—the food of the creature—is imbibed; the tube which proceeds from it not, however, becoming a proper intestinal canal, but soon dividing into two large branches, and ending in minute ramifications in all parts of the body. Prodigious numbers of flukes are sometimes found in the liver of a single sheep, and of very different sizes, but they are now believed not to multiply there as was formerly supposed. Their eggs, indeed, are produced there in great quantity, but find their way into the outer world to begin a series of transformations not yet very accurately traced with regard to this particular species, but of which the general nature is known. See CERCARIA, TREMATODE WORMS, and GENERATIONS, ALTERNATION OF. It seems that the young flukes, having entered as *cercariæ* into the bodies of mollusks or of aquatic insect larvæ, are conveyed into the stomachs of ruminants feeding on herbage to which these are attached, and finding their way to the liver, there attain their full development See ROT.

Instances have occurred of the presence of *distoma hepaticum* in the human liver and *vena portæ;* as well as of a similar species, *D. lanceolatum;* a small species of the same genus, *D. heterophyes*, has been found in great numbers in the human intestines in Egypt, but its influence on the system is unknown; a species of much elongated form, *D. hæmatobium*, is very common in Egypt, infesting the *vena portæ* of man, and the walls of the urinary bladder, and producing local, and afterwards general disease; a small species, *D. ophthalmobium*, has been found in the human eye, but probably through some such accident as in another case has led to the occurrence of the common F. under the skin of the foot, where it caused a sore. Of all the known species, the Egyptian, *D. hæmatobium*, is by far the most hurtful, as infesting the human body. This species is also remarkably different from the others, in not being hermaphrodite, and in the extreme dissimilarity of the male and female; the female being a thread-like worm, for which a lodgment is provided in a furrow (*gynæcophorus*) on the ventral surface of the male.

The genus *distoma* or F. contains a great number of species, infesting, in their mature state, different kinds of animals, and finding their appropriate place in very different parts of the animal frame. The wrinkled membrane around the eyes of birds is the place of some.

FLUME, THE, a gorge in the Franconian mountains, Lincoln, N. H. shut in between high walls of rock. It is much frequented by summer tourists, and a cascade some 600 ft. in height adds to its picturesque charm. Littleton, in Grafton co., is 16 m. distant.

FLUOHYDRIC ACID, or HYDROFLUORIC ACID. See FLUORINE, *ante*.

FLUORES'CENCE is the term applied to a peculiar blue appearance exhibited by certain substances exposed to sunlight, and especially observable in a dilute solution of sulphate of quinine.

FLUORESCENCE (*ante*), the action of certain substances which absorb light waves of short wave-length and re-emit the same light energy in waves of greater length. Some experiments are thus: A beam of sunshine, thrown by a mirror into a dark room through a hole in a shutter, is made to traverse a sheet of violet-colored glass, or a tank containing a strong solution of copper ammonia-sulphate. All but violet and actinic rays are excluded, and the room is nearly dark. If we place in the violet beam a mass of uranic nitrate it blazes with green, illuminating the room. Potassic chromate, or potassic ferrocynanide, remains dark in the same beam. If the beam traverse a jar of water upon which float some chips of horse-chestnut bark, beautiful streams of blue run down as the water dissolves the esculine of the bark. A transparent solution of quinine appears opaque, with a luminous milky precipitate. Designs in paper, drawn with quinine sulphate, though invisible in common light, become luminous in the violet beam: if drawn with varnish thickened with thallene, the effect is yet more brilliant. The design may be cut from paper coated with thallene and pasted on other paper; in electric light which has passed through yellow, green, or red glass, nothing will appear, but in light through cobalt blue glass, the thallene sketch will glow like fire against a background of black velvet. If the light be analyzed by a prism, the thallene or quinine designs will become luminous not only in the blue or violet parts of the spectrum, but also in that part usually black, where the actinic rays fall. It will be remembered that a pencil of light is a compound which may be analyzed by a prism, the result being several pencils of light of different vibrating, or wave-lengths; that the longer waves are those of the red, the wave-lengths constantly diminishing to the violet, and to the extra-luminous or chemical rays, whose plane in the spectrum is beyond the violet. Ordinary substances have no power to vary the wave-lengths, but either absorb

the light or return it unchanged. A red object seems so because it absorbs all other light and returns the red rays; if the object is placed in light from which the red is removed, as in the green of the spectrum, the object having no red to return, returns nothing, and is black. Hence, an object may show very different color when the light comes from it by transmission or reflection; for example, it may reflect only red, transmit only green, and absorb the remainder. In 1832, prof. G. G. Stokes described a series of observations and experiments and explained the nature of the action called fluorescent. The subject has also been investigated by Becquerel, Hagenbach, and Morton.

The power of exciting fluorescence exists in all rays, but is most notable in the very short rays of the violet. Bodies which have any capacity for fluorescence will show it in the violet, and may show it in other parts of the spectrum. For most bodies there are special wave-lengths which show fluorescence better than other wave-lengths which lie between. Fluorescent excitement and absorption are in some degree correlated; thus, in general, those rays which are most powerful exciters are most absorbed; so that if a beam of light has been sifted by a prism, those rays may be missing which most excite fluorescence. This applies to light, but not to bodies. Many absorbing bodies, as permanganate of potash, have no fluorescence whatever, while certain fluorescent bodies have very complex selective absorption.

The most powerfully fluorescent bodies known are the following: *Solids:* thallene, emerald green; chrysogen, light green; chrysene, yellow green; platino-cyanide of barium, uranic salts generally, and especially certain phosphates, double oxychlorides, and sulphates, also canary-glass, emerald green; platino-cyanide of magnesium, red; platino-cyanide of potassium, blue; solarized thallene (petrolucene), blue; anthracene, purplish blue. *Solutions:* acid quinine sulphate in water, blue; alkaline or neutral esculine in water, blue; bichlor-anthracene in alcohol, purple; bisulpho-bichlor-anthracenic acid in water, purple; extract of stramonium-seeds in water or alcohol, green; solution of morin, obtained from fustic or Cuba-wood in water, with alum, green; alcoholic solution of chlorophyl, best obtained from tea-leaves exhausted with water previously, red. The list includes only some of the more brilliantly fluorescing bodies, and might be greatly extended.

FLUORIDE OF ALUMINIUM AND SODIUM. This is the mineral *cryolite*, which is found in large quantities in Greenland, and is an important source of the metal aluminium (q.v.), and also of caustic soda, which is used in the manufacture of soap, carbonate of soda, and various salts; also of an opaque white glass (see SODA). The formula of *cryolite* is $Al_2F_6 6NaF$, a double fluoride of aluminium and sodium, having the percentage composition of fluorine 54.2, aluminium 13, sodium 32.8. See ALUMINIUM.

FLUORIDE OF CALCIUM. See FLUOR SPAR, *ante*.

FLUORIDE OF SILICON. This interesting compound is prepared by heating a mixture of powdered quartz, sulphuric acid, and fluor spar in a glass flask. A double reaction takes place, by which hydrofluoric acid and sulphate of calcium, water, and the gaseous fluoride of silicon are evolved. The gas is colorless, and very suffocating if breathed; on that account must be dealt with very cautiously. Water decomposes it into silica and hydrofluosilicic acid. See FLUORINE.

FLUORIDE OF SODIUM. This salt, which is the cheapest of the soluble salts of fluorine, is prepared by the action of hydrofluoric acid on carbonate of soda. It is also conveniently prepared by fusing a mixture of twenty parts of Glauber's salt, fourteen of carbonate of lime, and ten of fluor spar, with an excess of charcoal. The fluoride of sodium nearly pure may be extracted by water in percolation. Oxysulphide of calcium remains as an insoluble residue on the filter.

FLU'ORINE is an elementary substance allied to chlorine. Its principal natural source is the mineral, fluor spar (CaF), although it is also found in minute quantities in the igneous rocks, natural waters, plants, the bones and teeth of animals, as also in milk, blood, etc. Many attempts have been made to isolate F., but these have all failed, owing to the extremely energetic nature of the substance, which causes it to unite with substances the moment it is liberated from a previous state of combination. Thus, if F. is evolved in glass, gold, platinum, or other metallic vessels, it immediately acts upon and unites with the material of the vessel, and ceases to be free and pure. It would appear, however, to be a gaseous substance, having the equivalent number 19, and with properties similar to chlorine, though differing in energy of action. The compounds of F. are not numerous, but are important. *Hydrofluoric acid*, or *fluoric acid* (HF), is generally prepared by heating gently in a lead still a mixture of one part of fluor spar (CaF) with two parts of sulphuric acid ($HOSO_3$), when the vapors of hydrofluoric acid (HF) are evolved, whilst sulphate of lime ($CaOSO_3$) is left in the still. The dense acid vapors are conducted through a lead pipe into a lead receiver or bottle, surrounded by a freezing mixture of ice and common salt. The acid is generally mixed with water when desired to be kept for some time. When the most concentrated hydrofluoric acid is required, the still and receiving vessel must be made of platinum. The other metals are not suitable for such apparatus, as they are rapidly corroded by the acid. When prepared in its strongest form, hydrofluoric acid has the density of 1060 (water = 1000),

and is a colorless, fuming liquid of great volatility, which boils at 60° F., and does not freeze at −4° F. Not only does hydrofluoric acid corrode and dissolve the ordinary metals (excepting lead and platinum), but when placed on the skin it produces a severe burn, owing to its caustic nature. The most important property which hydrofluoric acid possesses is its power of eating into and dissolving glass, which admits of its application in the etching of characters upon glass, as in thermometer tubes, and for eating away greater or less thicknesses of plates or sheets of colored glass, so as to produce a variety of shades. See GLASS and GLASS-PAINTING.

FLUORINE (*ante*). Fluorine has a strong tendency to form double fluorides: those containing hydrogen have acid reactions, as hydrofluosilicic acid, $2HF,SiF_4$; hydroborofluoric acid, HF,BF_3. This tendency to form double salts has suggested the idea that fluorine is diatomic, and that its equivalent should be 38 instead of 19. On this hypothesis, which, however, is not generally accepted, hydrofluoric acid could be H_2F, instead of HF. Hydrofluosilicic acid, or silicofluoric, or fluosilicic acid, is formed by the action of water on fluoride of silicon (q.v.). The reaction may be represented as follows: $3SiF_4 + 2H_2O = 2H_2SiF_6 + SiO_2$. A special apparatus is required on account of the tendency of the gelatinous silicic acid, one of the results of the decomposition, to stop up the tube which delivers the gaseous fluoride of silicon. This stoppage takes place when the tube is moist. By sinking it beneath the surface of mercury which underlies the water, the difficulty is obviated. When the bubble of gas escapes from the mercury and rises above the water, that part of the silica which has not escaped forms a sort of envelope, and a continuous tube of silica is often formed. The acid solution is cleared by passing it through linen, ordinary filtration being impracticable, as the filter is liable to become clogged. A modification of the process has been introduced by Tessie Du Motay, which has an important relation to arts and manufactures. A paste composed of alumina, fluor-spar, carbon and silica is baked into bricks, which, on being melted again in a furnace, become decomposed, the fluoride of silicon passes off, and leaves a residuum in the furnace. The gaseous fluoride of silicon is passed through a series of wooden chambers in which sprays of water are arranged to play upon sloping shelves of glass. The acid solution is carried by gravity from one chamber to another until it contains about 8 per cent of acid. It is a sour fuming liquid which does not ordinarily corrode glass. When evaporated in glass, however, decomposition takes place, and the hydrofluoric acid which remains combines with the glass. Hydrofluosilicic acid is used in testing for barium and potassium. It is proposed to use it in preparing various salts from the potassium chloride beds at Stassfurt, Germany.

FLUOR'OTYPE, a process in which salts of fluoric acid are employed for the purpose of producing pictures by the agency of light. It was suggested by Robert Hunt in 1844. Two solutions are prepared: one containing 20 grains of bromide of potassium to one ounce of water; and the other, 5 grains of fluoride of sodium to an ounce of water. These are mixed together just previous to using, and applied uniformly over the whole surface of good paper, which is then allowed to dry, and afterwards rendered sensitive by brushing over it a solution of nitrate of silver, 60 grains to an ounce of water. Papers so prepared may be used for the production of pictures in the camera or printing-frame; they require, however, to be intensified by development with protosulphate of iron, the reducing action of which should be regulated by the addition of acetic acid to the solution. The sensibility of the papers for camera-work may be much increased by brushing over them a weak solution of protochloride of tin previous to exposure.

FLUOR-SPAR, a mineral which has been often described as chemically *fluate of lime*, a compound of fluoric (hydrofluoric) acid and lime, but which is in reality *fluoride of calcium* (CaF), consisting of 48.14 fluorine and 51.86 calcium (the base of lime). It occurs both crystallized and massive; the massive varieties exhibiting a crystalline structure; the crystals usually in groups, sometimes of the primary form, which is a cube, but often of secondary forms, of which there is great variety, as the octahedron, rhombic dodecahedron, etc. F. S. is sometimes colorless, but often green, blue, yellow, or red, more rarely gray, or even black; different shades of color frequently appearing in the same specimen, and in the massive varieties beautifully intermixed. Its colors often rival those of the most beatiful gems; but it is of very inferior hardness, being scratched even by quartz. Its specific gravity is 3.14. It generally becomes phosphorescent when heated, although this is more remarkably the case with some varieties than with others; it is decomposed by heated sulphuric acid, with evolution of hydrofluoric acid as a pungent gas, which, having the property of acting upon and corroding glass, F. S. is used with sulphuric acid for etching on glass. F. S. is also used for ornamental purposes, being wrought into vases, etc., for which it was in high esteem among the ancients. But the greater abundance in which it is now obtained has diminished the value of ornaments made of it. It is very commonly associated with ores of tin, silver, lead, and copper, occurring chiefly in veins, but is also found by itself in drusy cavities in granite, greenstone, etc. It is found only in a few places in Scotland, and in insignificant quantity, but is nowhere more abundant than in England, particularly in Derbyshire and in Cornwall. In Cornwall, it is used as a flux for reducing copper ore. In Derbyshire, the blue massive variety is known to the miners as *Blue*

John. The manufacture of ornaments of F. S. is carried on to some extent in Derbyshire. F. S. is often called DERBYSHIRE SPAR.

FLUOSILICIC ACID. See FLUORINE, *ante.*

FLUSH, a term used in the navy in reference to decks, which are said to be flush when extending without break on one level from the bow to the stern. Frigates and all smaller vessels of war (excepting a few steamers) are now constructed with flush upper-decks; but what are technically termed "flush-decked ships," are such as have all their guns on the upper-deck, as corvettes, sloops, brigs, and smaller vessels.

FLUSHING, a township and village in Queen's co., N. Y., on Flushing bay, a projection of Long Island sound, 8 m. n.n.e. of New York; on the n. side division of the Long Island railroad; pop. of township, '75, 15,357; of village, nearly half as many. In addition to railroad, there is constant steamboat communication with New York and other places. The village is one of the most charming in a delightful region. The streets are wide and well shaded, the houses stand apart and are surrounded with fruit trees and shrubbery, and the country round is highly cultivated. For nearly a century this village has been famous for nurseries of fruit and forest trees and flowers. It is a favorite place of residence for the business men of New York and Brooklyn; and in and near the village the descendants of some of the most important of the old Long Island families have found a home. As lately as 1873, the large oak tree under which George Fox, the famous founder of the sect of Quakers, so often preached, was still flourishing. Few places are better supplied with churches and educational institutions. Among the latter are the Flushing seminary for girls, St. Joseph's academy for young ladies, St. Joseph's convent, and St. Mary's seminary for boys. There are nearly a dozen churches, representing all the leading denominations. The villages of College Point and Whitestone are included in the township.

FLUSHING (Dutch *Vlissingen*), a strong fortress and seaport of the Netherlands, in the province of Zealand, is situated on the s. coast of the island of Walcheren, on the northern shore of the mouth of the western Scheldt, in lat. 51° 26′ n., and long. 3° 36′ east. It was formerly an important naval station of the Netherlands, and had extensive dockyards and arsenals. The harbor can receive large seagoing vessels, and a considerable trade is carried on between England, India, and other countries. A railway constructed through Zealand to join the main continental lines, has its terminus station close to the harbor, and a daily service by very superior steamers has been begun between F. and Queenborough, on the London, Chatham, and Dover railway. F. is strongly fortified, and commands the entrance of the Scheldt. Pop. (1st Jan., '75), 9,471. F. is the birthplace of admiral de Ruyter. It was stormed and taken by the English in the Walcheren expedition under lord Chatham in 1809.

FLUSTRA, a genus of zoophytes, of the class *polyzoa* (or *bryozoa*) and order *infundibulata*, some of the species of which are very common on the British shores. The name is said to have been derived by Linnæus from the Saxon *flustrian*, to weave, because of the mat-like structure of the polypidoms, which in this genus are extremely plant-like, and by unscientific observers are generally regarded as belonging to the vegetable, and not to the animal kingdom. In some species, the polypidom assumes the appearance of a branching frond, with polype cells either on one side only, or on both sides; in others it extends as an incrustation on rocks, shells, sea-weeds, etc. The polype cells are arranged quincuncially, and are in juxtaposition, more or less quadrangular, flat, and with a distinct border, which is sometimes furnished with teeth or short spines. The polypes have the power of moving either the whole head at once, or the tentacles separately, and show no little activity, so that a living F., seen through a magnifying-glass, is a most beautiful and interesting object. One of the most common British species is *F. foliacea*, which grows on hard ground in a few fathoms' water, and is continually to be found torn up by the waves, and scattered on the shore. It is an interesting fact, that the same species occurs in the Pacific ocean.—A single square inch of *F. carbasea*, another common British species, has been found to contain 1800 cells; and as there are about 10 square in. in an average polypidom, a single specimen may ordinarily contain about 18,000 polype heads.

FLUTE, one of the oldest wind instruments, well known to the ancient Greeks, has a soft and pleasant quality of tone, is an important instrument in orchestral music, and, in consequence of its easy treatment, is, in modern times, much in favor with amateurs. The F. is commonly made of boxwood or ebony, but sometimes of ivory or silver. Its form is that of a taper tube, made in 4 pieces, with 6 holes for the fingers, and with from 1 to 14 keys, which cover or open other holes. The sound is produced by blowing from the mouth into the embouchure, an oval kind of hole at one side of the thick end, which is done by the lips covering a part of the hole, so that the air in its passage from the mouth is broken against the opposite edge of the hole, which causes the column of air inside the tube to vibrate. The notes of the gamut are produced by the opening or shutting of the holes by the fingers of both hands. The compass of the flute is from D to A sharp, 19 diatonic intervals. For solo-playing, a F. with a compass from G to C is sometimes used. For orchestral purposes, there are also the *tierce* F., the octave F., the E flat and F piccolo flute; and the

highest of all, the C piccolo. Improvements on the F. have been made from time to time by Quantz, Ribock, Trommlitz, and especially by Böhm in Germany, and by Rudell and Rose in London.

FLUTE-WORK, the name given to a particular class of stops in organ-building, in contradistinction to *reed-work*. There are also numerous stops in German organs, specially designated with the names of flutes of different kinds, of 8 ft. and 4 ft. pitch, some of which have lately been introduced into English organs.

FLUTING, the moldings in the form of hollows or channels cut vertically on the surface of columns. These were adopted by the Greeks as ornaments to their Doric, Ionic, and Corinthian columns, and were retained by the Romans in their architecture. The Tuscan is the only style without flutes. In Doric there are 20 flutes on the circumference, and the curves meet with a sharp edge. These curves are supposed, in Greek Doric, to be elliptical, and they are carried up across the necking to the base of the cap. In the other styles, there are 24 flutes on the circumference. These are semicircular, and are separated by a small fillet; and, before reaching the necking and the base, are terminated with semicircular top and bottom.

Flutes are said to be cabled when they are filled in to about ⅓ of their height from the base with a convex bead. This is done to strengthen the column and protect the flutes. In countries where Roman remains were abundant, as in the s. of France, F. was sometimes adopted by the early mediæval architects, as at Arles and Autun. In Italy also, traces of this decoration are visible during the middle ages; but the flutes soon ceased to be vertical, and, in Romanesque architecture (q.v.), assumed many varieties of forms, such as curves, zigzags, etc., twisting round the shafts.

FLUVANNA, a co. in central Virginia, on the James river, intersected by the Rivanna river; the James river canal passes along the s. border; 170 sq.m.; pop. '70, 9,875—5,097 colored. The surface is generally level, and the soil is fertile, producing corn, tobacco, wheat, and oats. Co. seat, Palmyra.

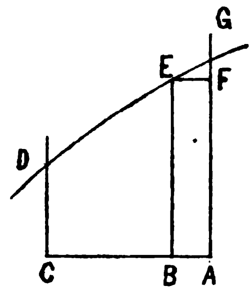
FLUX (*fluo*, I flow) is the term given to the substances employed in the arts which cause or facilitate the reduction of a metallic ore and the fusion of the metal. *White flux* is an intimate mixture of 10 parts of dry carbonate of soda and 18 parts of dry carbonate of potash, and is mainly instrumental in withdrawing the silica or combined sand from mineral substances; *black flux* is prepared by heating in close vessels ordinary cream of tartar (bitartrate of potash), when an intimate mixture of finely divided charcoal and carbonate of potash is obtained. The latter F., when mixed with finely divided metallic ores, and the whole raised to a high temperature in a furnace, is not only useful in removing the silica, which the carbonate of potash it contains enables it to do, but the charcoal withdraws the oxygen from the metallic oxide, and causes the separation of the pure metal. Limestone is employed as the F. in the smelting of iron ores. The other fluxes are fluor spar, borax, protoxide of lead, etc. See IRON, COPPER, etc.

FLUX (Lat. *fluxus*, from *fluō*, I flow), a discharge, generally from a mucous membrane. The term is applied more or less frequently to all preternatural fluid evacuations from the body, but especially to those from the bowels, and from the uterine organs. Dysentery (q.v.) was long termed the bloody F., to distinguish it from simple diarrhea. Another scientific term for F. is profluvium, which gives the name to a large order of diseases in Cullen's *Nosology*. See also CATARRH, MENSTRUATION, and, with respect to etymology only, RHEUMATISM.

FLUXIONS, in mathematics. The method of fluxions invented by Newton was intimately connected with the notion of velocity uniform and variable; and extended that notion, derived from the consideration of a moving point, to every species of magnitude and quantity. It proposed to determine, in all cases, the rate of increase or decrease of a magnitude or quantity whose value depends on that of another, which itself varies in value at a uniform and given rate. If x and y represent two such quantities, and $y = F(x)$ represent the law of their dependence, and if $\dot{x}$ be supposed to be the velocity with which x increases, and $\dot{y}$ that with which y changes value. Newton undertook by his method to express $\dot{y}$ in terms of $\dot{x}$ and of x, or to find $\dot{y} = F_1(x).\dot{x}$. The quantities x and y, which in modern language we call the variables, he called *flowing* quantities or *fluents*, and $\dot{x}, \dot{y}$, which we should represent by dx and dy, and call differentials, he called the *F.* of x and y. See CALCULUS. To illustrate his notation: suppose $y = x^n$, it may be shown that $\dot{y} = nx^{n-1}\dot{x}$. Regarding now $\dot{y}$ as a quantity depending on x and $\dot{x}$, and supposing x to increase uniformly, in which case $\dot{x}$ is constant, and $\overset{+}{(x)}$ its fluxion zero, we observe that $\dot{y}$ may have a fluxion, for it depends on the value assumed by $nx^{n-1}.x$, when x further changes. We find $\overset{+}{(y)} = n.(n-1).x^{n-2}.(\dot{x})^2$. Thus, second fluction or velocity of $\dot{y}$, or $\overset{+}{(y)}$, Newton wrote $\ddot{y}$. If x had a second fluction, or did not change uniformly, then that fluction he wrote $\ddot{x}$. The third fluction of y he wrote $\dddot{y}$; and so on, pointing

as many points over the fluent as there are units in the order of the fluxion. For the fluent, he had no special symbol. Instead of $\int nx^{n-1}dx = x^n$, according to the modern notation, he wrote $\left|\overline{nx^{n-1}.\dot{x}}\right|$, putting the expression in an inclosure. For the principles on which Leibnitz founded his calculus and its notation, see CALCULUS.

FLUXIONS (*ante*). Imagine a point to move uniformly in the direction of a fixed line, and, at the same time, to have a variable transverse motion depending upon a law which determines the character of the curve or line thus generated. The indefinite part of the curve up to any point, as D E in the diagram, is the *fluent* and the exceedingly small element of the curve that is generated in the next infinitesimal, but constant, period of time, as *E G*, is the *fluxion*, These are both variable except in the case of straight lines.



Let E denote the location of the generating point at any time, t; C A the straight line in the direction of which motion is uniform, and C D a line perpendicular to C A. Let E F be the distance through which E moves parallel to C A, and F G the distance parallel to C D in the next infinitesimal though constant space of time $d\,t$. Then, at the end of the time $t + d\,t$ the point will be at G, and E G will be the part of the curve generated in the time $d\,t$.

Passing from the consideration of the motion of a point in a plane to that of a point in space, it is evident that the generating point will describe a straight line, or a curve of single or double curvature. Equations can be constructed formulating laws of motion which will cause the general point to trace any curve whatever, and from these equations the natures of the curves can be discovered. The science of fluents and fluxions is based upon the above principles.

Any plane figure can be generated by the motion of a straight line, and any volume by the motion of a plane figure. In all cases, the portion of a plane figure or volume generated in the time t is the fluent, while that generated in the time $d\,t$ is the fluxion. In practice, the method of integrals and differentials has superseded the system of fluents and fluxions, chiefly because the rotation of the latter is too cumbersome. The fluxion of a fluent is represented by a dot over a letter, or, in complicated expressions, by a dot occupying the position of an exponent outside of a parenthesis; thus $\dot{x}$ denotes the fluxion of x, and $\left(\frac{\sqrt{x-y}}{x^2}\right)^{\cdot}$ denotes the fluxion of $\frac{\sqrt{x-y}}{x^2}$. For fluxions of a higher order a dot is written over the fluent or without the parenthesis for each unit in the order.

FLY, a popular name often given to insects of the order *diptera* (q.v.) generally, sometimes extended to insects of other orders, and sometimes limited to the *muscidæ* (q.v.). It is often used with a prefix, as house-fly, blow-fly, etc., to designate particular kinds of insects.

FLY-CATCHER, *Muscicapa*, a genus of birds of the order *insessores*, tribe *dentirostres*, and family *muscicapidæ*, having a moderately long angular bill, broad and depressed at the base, compressed and slightly curved at the point; the base surrounded with hairs or bristles directed forwards, and which help to secure insect prey. The legs and feet are small; the outer toe the longest, and attached to the middle one as far as the first joint. The wings are not long; their first quill-feather is very short; the third is the longest. The birds of this genus, as now restricted, are exclusively confined to the old world, and mostly to the warmer parts of it. Of the numerous North American birds often called fly-catchers, some belong to nearly allied genera, and others to genera not now ranked even in the same family. The true fly-catchers all have the habit—characteristic of many of the *muscicapidæ* beside this genus—of remaining perched for a long time in the same spot, only leaving it to make a sudden dart at a passing insect, which is seized with a snap of the bill, and then returning. They are almost never to be seen running on the ground, or even on the branches of trees, and do not chase insects in the air like swallows. Only four species are European, two of which are British—the SPOTTED F. (*M. grisola*) and the PIED F. (*M. atricapilla* or *luctuoso*); birds about the size of a sparrow, the former of which is common in most parts of England, as a summer bird of passage, but rare in Scotland; the latter is rare in Britain, although abundant in the s. of Europe. The spotted F. is brownish gray above, white beneath, the head and breast marked with dusky spots. Its voice is a mere chirp. It is remarkable for the choice it makes of situations for its nest, often on a beam in an outhouse, on the side of a fagot-stack, on the branch of a tree trained against a building, and sometimes even on a lamp-post in a street. Mr. Durham Weir of Boghead, who was a diligent observer of the habits of birds, mentions that he witnessed a single pair of spotted fly-catchers feed their young no fewer than 537 times in one day, and that their motions were so rapid that he could not keep his eye off the nest for a moment.

The name F. is often extended to other genera, and is sometimes used as co-extensive in signification with that of the family *muscicapidæ*.

FLYING—FLIGHT, is the locomotion of an animal in the air, by means of *wings*, organs specially adapted to that purpose. By means of these organs, the animal raises itself from the ground and sustains itself in the air, as well as moves forward in any direction it desires. Birds and bats are the only existing vertebrate animals possessing the power of true flight: the lateral membranes of flying squirrels, flying lemurs, flying phalangers, and flying dragons, and probably even the great pectoral fins of flying fishes, serving only to sustain them in the air after the manner of a parachute, or at most to aid, on the principle of a boy's kite, in an oblique ascent. The extinct reptiles called pterodactyles (q.v.) possessed, however, the power of true flight, as their remains sufficiently testify; and their wings were constructed on a plan as different from those both of birds and of bats as these (see BIRDS and BATS) are from each other. The wings in all vertebrate animals are the anterior limbs, and are thus homologous to the arms of man and the forelegs of ordinary quadrupeds; in birds, the bones answering to those of the hand are much abbreviated and consolidated; in bats, they are prodigiously elongated; in pterodactyles, there was an elongation of a single finger. Among birds, although the power of flight is general, there are exceptions to the rule, the wings of some being merely rudimentary, and at most only helpful to them in running, those of others being adapted to swimming, not on the surface of, but under water.—The only invertebrate animals possessing the power of flight are insects; to the greater part of which vastly numerous class it belongs in their perfect state, although there are also many insects which are quite destitute of it, and this is sometimes the case with species very closely allied to others which possess it, nay, sometimes this great difference exists between the sexes of the same species. The wings of insects are not at all homologous to those of the flying vertebrata, although applied to the same use, and in structure are widely different from them all. See INSECTS.

In flying, the wings are made to beat or strike the air. The stroke in the one direction, however, must be very different from that in the other, or rather from that movement by which the wing is brought back to its place for another stroke. This difference is secured partly by greater force of muscular action, and consequent rapidity; the resistance of the air varying as the square of the velocity with which the wing moves in giving the stroke. But it is also secured partly by the conformation of the wing itself, the quill feathers of birds being so placed that they strike the air with their greatest extent of surface in the proper stroke of the wing, and *obliquely as it returns to its place.* An imitation of this is made in the rowing of a boat, and is called *feathering the oar.* The wings of bats, consisting of a membrane extended upon jointed bones, are probably in part folded up in order to the return from every stroke; and this is perhaps the case also with the wings of some insects, although those of others—as the common fly and the bee—are certainly incapable of it; yet it is possible that even these may have a greater degree of rigidity communicated to them by the inflation of their air-tubes during the stroke than they have during the return.

Flying is analogous to swimming; but the difference of medium is very great, fresh water being about 800 times heavier than air, and the density of sea-water still greater. The bodies of animals intended for flight are therefore sometimes adapted to it partly by means which tend to diminish their proportionate weight, as the air-cavities in birds and insects; which, however, are still more important in relation to the increase of muscular power; and it is chiefly by the increase of muscular power that the power of flying is imparted. The exercise of strength requisite for swimming is comparatively small, about $\frac{1}{100}$th part only of that which is requisite for flying. How wonderful, then, the muscular power of birds capable of long-sustained flight, far exceeding in rapidity the speed of the swiftest locomotive engine ever constructed by man! or of insects, which in respect at least of rapidity, is in some species not inferior to that of the swiftest birds! The muscular power exerted in flying evidently differs very much both among birds and among insects. The large wings of some require also much less frequent muscular action, either to sustain the body in the air, to elevate it, or to move it foward, than the comparatively small wings of others. The motion of the wings of humming-birds and of insects is too rapid for the eye to follow.

It is not to be wondered at that projects of locomotion through the air have been much entertained by men, nor that, whilst the force of the objections already stated was unknown, artificial wings, and an imitation of the flight of birds, occupied the ingenuity of inventors. Grecian fable ascribes success to the mythic Dædalus (q.v.), who is said to have passed safely over the Ægean sea on wings which he himself had made. More modern stories of similar success, although in far shorter flights, are numerous, but often resolve themselves, when carefully examined, into exaggerated accounts of feats performed on ropes, wings having been perhaps employed to render the exhibition more attractive, perhaps also to render the performance more easy by their extent of surface and resistance to the air. Other instances are on record of persons who, apparently by some parachute-like contrivance, descended obliquely from high towers to a considerable distance; as, in the 13th or 14th c., Elmerus, a monk, is said to have flown more than a furlong from the top of a tower in Spain, but the distance is probably much exaggerated; and in the 17th c., Besnier, a locksmith of Sable, in France, who prudently began from windows one story high, ventured at last and safely to leap from very elevated positions, and so passed over houses or over rivers of considerable breadth. All

these, however, were mere feats destitute of utility, although they encouraged the expectation of better results, which was cherished by some of the most scientific men of that period. Bishop Wilkins, in particular, devoted much attention to this subject. Perceiving the inadequacy of the human arm and the muscles, which move it to give sufficiently rapid motion to wings of sufficient size, he suggests that "it were therefore worth the inquiry to consider whether this might not be more probably effected by the labor of the feet, which are naturally more strong and indefatigable." So confident was he of success, that he anticipated the time when a man should as readily call for his wings to make a journey, as he then did for his boots and his horse. More recently, in the end of the 18th and beginning of the 19th c., sir George Cayley occupied himself with speculations and experiments on this subject. Acknowledging the difficulty which arises from the want of muscular strength in man, he says: "It is only necessary to have a first mover, which will generate more power in proportion to its weight, than the animal system of muscles." But this first mover has not hitherto been found. The employment of steam for this purpose has been frequently proposed. Attempts of this kind, however, have rather for their object aërial navigation than artificial flying, properly so called; although the inventions have been variously designated aërial ships, flying machines, etc. A great difficulty has been found in the weight of the steam-engine and its fuel; and experiments, which have cost no small sums, and have excited not a little of public attention, have signally failed through miscalculation on this essential point. Not unfrequently, attempts have been made to combine some modification of the balloon with the steam-engine or other means of propulsion. In no instance, hitherto, has there been the least approach to success, although a *European aëronautical society* was formed, and issued its advertisements in 1835; and about eight years afterwards, an *aërial transit company* not only amused the public for a considerable time, but obtained the assent of the British house of commons to a bill for its constitution. Models have sometimes been exhibited of aërial machines capable of being guided at the pleasure of the aëronaut, in a perfectly still atmosphere, but nothing has yet been invented capable of serving any practical or useful purpose. There is, however, nothing evidently contrary to science or sound philosophy in proposals for aërial navigation, which, in this respect, differs widely from human or artificial flying.

Perhaps the *aëronautic fish*, on which Marshal Ney is said to have spent 100,000 francs, and which for a considerable time occupied the attention of some of the most ingenious and scientific men in France, deserves particular notice. It was a large balloon, of a long fish-like figure, intended to swim in the air, as a fish in water, and to be propelled by wings or fins working by cranks. But when launched, although it floated and moved forward a little, it turned on one side, and this tendency could not be corrected, so that the experiment proved a complete failure. Dr. Pettigrew's book on *Animal Locomotion* (1873), and the controversy regarding the theories of flight there advanced, carried on in *Nature* (1874) and elsewhere, form a recent contribution to the literature of the subject. For further information, see *Chambers's E. Jour.*, No. 227, N. S.

FLYING—FLIGHT (*ante*). The problem of aërial navigation has a strong fascination, which is not confined to men of science alone. When we remember the marvelous freedom of movement enjoyed by volent as compared with non-volent animals, it is not surprising that the ability to fly has always been an object of ambition with man. The traditions of Dædalus and Icarus illustrate the attempts of the ancients in this direction; while the aeronautic societies existing at the present day in Great Britain, France, Austria, and other countries, show that the subject has a permanent hold upon the imagination and the interests of mankind. The societies alluded to embrace men of the highest scientific attainments, and as they evince great activity and publish their proceedings at regular intervals, the world is likely to be promptly apprised of any new discovery. Men of science in general have no belief that the dreams of the enthusiasts will ever be fulfilled; but there are some who think it not too much to hope that mankind will ultimately learn to navigate the air as easily and safely as the water. It is a problem of mechanical science and skill; and they assert that the obstacles in the way of success are not apparently greater than those which two centuries ago were almost universally supposed to make steam navigation impossible. If the problem be ever solved, it will probably be by studying more closely than ever the structure and habits of volent animals. If men are to learn to fly, the birds must be their teachers. It is not evident how the balloon can ever be successfully employed for aërial navigation, for, though its vertical movement may to a certain extent be controlled, it is at the mercy laterally of every wind that blows; and so, while it may be kept for a long time afloat, it can never be sure of reaching any desired destination. Progress in aërostation, as in many other scientific inquiries, has probably been retarded by false analogies. The air cannot be navigated after the same fashion as the water, for it is a radically different element. A very slight consideration shows that although the muscles of man may not be of sufficient strength to enable him to use wings, it does not necessarily follow that he may not find a way of managing these appliances successfully by mechanical power. Flying creatures are for the most part as heavy, bulk for bulk, as other animals, and flight in every instance is the product, not of superior levity, but of weight and power directed upon properly constructed flying organs. This shows that a flying machine need not neces-

sarily be a light, airy structure, exposing an immoderate amount of surface. On the contrary, it suggests that it it should be a compact and moderately heavy and powerful structure, trusting for elevation and propulsion entirely to its flying appliances, whether actually moving wings, or screws, or aëro-planes wedged forward by screws. It should attack and subdue the air, without allowing the air an opportunity of attacking or subduing it. It should smite the air intelligently as a master; and its vigorous, well directed thrusts should in every instance be able to elicit an upward and forward recoil. The flying machine of the future, there is reason to believe, will be a veritable example of *multum in parvo.* It will launch itself into the ocean of air, from which, by means of its traveling surfaces, however fashioned and however applied, it will extract the recoil or resistance necessary to carry it forward. Art should follow nature in this matter. As there are active and passive surfaces in the flying animal, so there should be active and passive surfaces in the flying machine. The active surfaces in flying creatures are always greatly in excess of the passive ones, from the fact that the former virtually increase in proportion to the spaces through which they are made to travel. Nature not only distinguishes between active and passive surfaces in flying animals, but also strikes a just balance between them, and utilizes both. She regulates the surfaces to the strength and weight of the flying creature, and the air currents to which the surfaces are to be exposed and upon which they are to operate. In her calculations she never forgets that her flying subjects are to control and not to be controlled by the air. Prof. J. Bell Pettigrew, an English scientist, has analyzed the movements of flying creatures, and reproduced them by the aid of artificial wings. In his work *On the Mechanical Appliances by which Flight is attained in the Animal Kingdom*, 1867, he has given an account of his investigations and discoveries which will be of great advantage to all those who are trying to work out the problem of artificial flying, The first properly authenticated account of an artificial wing was given by Borelli in 1670. His investigations and experiments are of great value. His plan of artificial wing is indorsed by Chabrier, Straus-Durkheim, Giradr, and Marey. The latter reproduces Borelli's artificial wing, and even his text, at a distance of nearly two centuries. But the artificial wing of prof. Pettigrew is a more exact imitation of nature than Borelli's. He recommends a double elastic wing, to be applied to the air like a steam-hammer, by being fixed to the head of the piston. He also recommends an elastic aërial screw consisting of two blades which taper and become thinner towards the tips and posterior margins. The peculiarity of his wings and screws consists in their elasticity, their twisting action, and their great comparative length and narrowness. They offer little resistance to the air when they are at rest, and when in motion, the speed with which they are driven is such as to insure that the comparatively large spaces through which they travel shall practically be converted into solid bases of support. A revolution in the construction of flying models has taken place since the enunciation of prof. Pettigrew's issues in 1867. Elastic aëro-planes are now advocated by Mr. Brown, elastic aërial screws by Mr. Armour, and elastic aëro-planes, wings, and screws by M. Pénaud. The latter constructed models to fly by three different methods—1, by means of screws acting vertically upwards; 2, by aëro-planes propelled horizontally by screws; and 3, by wings which are flapped in an upward and downward direction. These models were so far successful as to make a considerable degree of progress and offer hints for future guidance. Mr. Henson designed a flying machine in 1841, combining aërial screws with extensive supporting structures. Mr. Wenham, in 1867, thinking to improve upon Mr. Henson, invented what he designated his aëro-planes. Mr. Stringfellow, who was originally associated with Mr. Henson, and constructed a successful flying model in 1847, built a second model in 1868, in which Mr. Wenham's aëro-planes were combined with aërial screws. This model was in view at the exhibition of the aëronautical society of Great Britain, held at the crystal palace, London, in 1868. It was remarkably compact, elegant, and light, and obtained the $500 prize of the exhibition for its engine, which was the lightest and most powerful ever constructed. The machine for which it was made was not successful. It violated nature, in that while it weighed less than 12 lbs., its engine exerted a third of a horse power. No flying creature of that weight possesses a tithe of the power indicated. In 1874, Mr. Moy invented an aërial steamer, consisting of a light, powerful skeleton frame resting on three wheels; a very effective light engine constructed on a new principle, which dispenses with the old-fashioned cumbrous boiler, narrow horizontal aëro-planes, and two very large aërial screws. In its general features, Mr. Moy's machine resembles that of Mr. Stringfellow. It must not be supposed that while foreign inventors have been working in this field the subject has not engaged attention on this side of the Atlantic. In the United States patent office reports may be found descriptions of hundreds of inventions for aërial navigation; but they all have proved delusive. Still, investigation and experiment are going on in Europe and America, and the engineers who persevere in this work in the face of so much discouragement deserve well of science. Most of them appear to have come to the settled conclusion that the mystery of flight can be cleared up only by an intelligent study of the structure and mode of application of the flying organs of animals. It is to natural flight and the principles which underlie it that the aëronaut must look for a solution of the intensely interesting but vastly complicated problem of aërial navigation. [Condensed from *Encyc. Brit.*, 9th ed.]

FLYING BRIDGE. See FERRY.

FLYING DRAGON, or FLYING LIZARD (*draco*), a genus of saurian reptiles, allied to iguanas and stellions, but remarkably distinguished from them, and indeed from all other reptiles now existing, by lateral membranes which support them in a parachute-like manner in the air, and enable them to pass from tree to tree, even to considerable distances. These membranes are supported on the first six false ribs, which, instead of encircling the abdomen, stand out at right angles from the body for this purpose. They are incapable of the movements requisite for true flying; when not in use, they are folded close to the body. There is also in the flying dragons an inflatable pouch under the chin, sustained partly by the hyoid bone and partly by two small bones. The tail is long. The scales are small and imbricated; those of the tail and limbs are keeled. The tongue is extensile, but not greatly so. All the species are of small size, live in trees, and feed on insects. They are natives of the East Indies. The genus is subdivided by some naturalists.

FLYING FISH, a name given to all those fishes which have the pectoral fins so very large that by means of them they are sustained in short seeming flights in the air. These fishes belong to two very different families—*scomberesocidæ* and *sclerogenidæ;* but the name F. F. is sometimes limited to those of the former family, the genus *exocætus;* those of the latter being known as *flying gurnards*. The genus *exocætus* has the pectoral fins nearly as long as the body, the dorsal fin placed over the anal, the tail forked, and its lower division considerably larger than the upper. It is subdivided by some naturalists into several genera, characterized by the presence or absence of barbels, etc. Two species have occasionally been seen near the British shores, one of which (*E. volitans*) is very abundant in the warmer parts of the Atlantic ocean, the other (*E. exiliens*) is common in the Mediterranean. In the former, the ventral fins are situated far forward, and are short; in the latter, they are situated far back, and are considerably elongated. More than 30 species are known, all inhabiting the seas of the warmer parts of the world, and having their respective geographical limits pretty exactly defined.

They swim in shoals; and whole shoals—varying in number from a dozen to 100 or more—often leave the water at once, darting in the same direction through the air, and after descending into the water at a distance of 200 yards, or even more, from the place where they arose, quickly renewing their flight. These flights of flying fishes form one of the most interesting and pleasing spectacles which relieve the monotony of a voyage in the tropical seas. Sometimes the coryphene (dolphin) may be seen in rapid pursuit, taking great leaps out of the water, and gaining upon his prey, which take shorter and shorter flights, vainly try to escape their persistent foe, until they sink at last exhausted: sometimes the larger sea-birds catch flying fishes whilst they are in the air; but it does not seem to be at all true that these fishes leave the water, as has been very generally imagined, merely to escape from danger, nor is there any good reason for that sentimental pity which has been often expressed with regard to them, as creatures harassed and persecuted more than others, and peculiarly exposed to dangers both in the sea and in the air. They seem rather to exercise their powers, like other creatures, very often merely from the delight which they take in the exercise of them, and from the exuberance of their happiness.—The question, whether or not the flying fishes use their pectoral fins at all as wings, cannot yet perhaps be considered as completely decided; some observers, well entitled to respect, maintain that they do, although, of course, their power of flight is limited to the time that the fins remain quite moist; but a great preponderance of testimony is in favor of the opposite opinion, which regards the fins as acting merely after the manner of a parachute or of a kite. Flying fishes sometimes rise to a height of 20 ft. above the water, although they more frequently skim along nearer to its surface. They often fall on the decks of ships. They are good food, and the natives of the South sea islands take them by means of small nets attached to light poles, like those in which anglers catch minnows for bait. For this purpose, they go out at night in canoes, to the outer edge of the coral reefs, with a torch, which enables them to see the fishes, and perhaps both attracts and dazzles them.

FLYING FOX. See KALONG.

FLYING GURNARD, *Dactylopterus*, a genus of fishes of the family *sclerogenidæ* or mailed cheeks, nearly allied to the gurnards (*trigla*), but remarkably distinguished by the great size of the pectoral fins, which they use for the same purpose and in the same way as the *exocæti*. See FLYING FISH. The pectoral fins are, however, of a very different appearance from those of the *exocæti*, widening almost to the end, which is rounded, and the tips of the rays extending considerably beyond the membrane. A very long spine rises from the back of the head. One species (*D. volitans*) is common in the Mediterranean, and is sometimes 15 in. in length. Its flight is said not to extend to more than about 40 yards, but it sometimes rises high enough to fall on the decks of large ships. "At particular times, especially on the approach of rough weather, in the night, numbers of them may be seen, by the phosphoric light which they emit, making their arched passages in apparent streams of fire."—Another species inhabits the Indian seas.—Some species of *apistes*, belonging to the same family, have similarly large pectorals, and make similar flights.

FLYING LEMUR, or COLUGO, *Galeopithecus*, sometimes also called **FLYING CAT** and FLYING FOX, a genus of mammalia, generally regarded as constituting a distinct family, *galeopithecidæ*, which, by some naturalists, is placed, as by Cuvier, among the *cheiroptera* (see BAT), although it is now more commonly associated with the lemurs (q.v.), as by Linnæus. There are, indeed, evident affinities both to lemurs and bats, but chiefly to the former, with which the osteological and other anatomical characters generally agree. Along the sides extends an ample membrane or fold of the skin, beginning behind the throat, and including both the fore and hind legs as far as the toes, but leaving them free, and further stretched along both sides of the tail to the tip. In the last particular, it differs from the lateral membrane of the flying squirrels and flying phalangers, and more resembles that of bats; but it widely differs from that of bats in being comparatively thick, and covered on both sides with short thick hair; and still more in leaving the fore-feet free, and not being stretched on lengthened finger-bones. Nor can it be used for true flight, but only to support the animal in the air like a parachute, enabling it to take enormous leaps of one hundred yards or thereby in an inclined plane. It is not yet satisfactorily determined whether the differences to be observed between the specimens of flying lemurs in collections, are to be regarded as differences of species or of variety. Attempts have been made to distinguish several species, but it is difficult on account of their great similarity. They are from 20 in. to 2 ft. in total length, are natives of the Indian archipelago, inhabiting lofty trees in dense forests, and feeding on small birds' eggs and fruits, as well as on insects. They are nocturnal in their habits. They are very inoffensive, and scarcely attempt to bite even when seized. Their voice resembles the low cackling of a goose. They produce generally two young ones at a birth. The Pelew islanders greatly esteem them as food, but they have a rank unpleasant smell.

FLYING PHALANGER, or FLYING OPOSSUM, *Petaurus*, a genus of marsupial quadrupeds, containing several species, natives of New Guinea and of Australia, where they are generally called squirrels or flying squirrels. They are nearly allied to the phalangers (q v.), which they particularly resemble in dentition, but have not the tail so long and prehensile, whilst they are distinguished by a hairy membrane or fold of the skin extending along the flanks, and used as a parachute to enable them to leap to great distances. This membrane extends along both fore and hind legs almost to the toes, but does not appear behind the hind legs, nor include the tail, which is pretty long and bushy, but which in some of them has a *distichous* character, the hair spreading out to the sides, and so rendering it useful in supporting as well as in guiding the body in the air. They are capable of modifying their course in the air, although not of true flight; and their aërial evolutions are very graceful. They repose during the day, and become active in the evening. They feed on fruits, leaves, insects, etc. A New Guinea species is about as large as a flying lemur; one of the Australian species is scarcely larger than a mouse. The fur of some of them is rich and beautiful.—PETAURIST has been proposed as an English name for this genus; but is not much used.

FLYING SQUID, *Ommastrephes*, a genus of cephalopodous mollusks, allied to the calamaries (q.v.) or squids, but differing from them in having the eyes exposed and not covered with skin, the fins united into one as a tail, and the *gladius* or bone furnished with three diverting ribs and a hollow conical appendage. The tail is large, and the power of locomotion great, so that these mollusks not only pass rapidly through the water, but leap out of it, and high enough sometimes to fall upon the decks of ships. They form a principal part of the food of many of the *cetacea*, and are often the prey of albatrosses, petrels, and other marine birds. They are used as bait for cod in the Newfoundland fisheries.

FLYING SQUIRREL, *Pteromys*, the name given to a considerable number of species of the squirrel family (*sciuridæ*), which have a fold of the skin of the flanks extended between the fore and hind legs, and partly supported by bony processes of the feet, by means of which they are enabled to take extraordinary leaps, gliding for a great distance through the air. The tail also aids to support them in the air, as well as to direct their motion, its hairs extending laterally "in a sort of feathery expansion." The dentition is similar to that of true squirrels, with which also the habits generally correspond. One species (*P. sibiricus*) is found in the n. of Europe and of Asia; several species are natives of North America, and others inhabit the s.e. of Asia and the Indian archipelago. The European species is about the size of a rat, grayish-ash color above, white below, the tail only half the length of the body; it lives solitarily in the forests. Its fur is of little value, but skins are sometimes mixed with those of the gray squirrel, to impose on the purchaser. The most common North American species (*P. volucella*), abundant from the gulf of Mexico to Upper Canada, is fully 5 in. long, with a tail of 5 in. additional, fur included. It is of a brownish-gray color above, white beneath; a black line surrounds the orbit of each eye. All the species inhabit woods, and the night is their time of activity. They feed not only on nuts and young shoots of trees, but also on small birds. They are extremely easy of domestication.

In gliding from tree to tree, the common American F. S. descends obliquely and with very rapid motion, until near the tree which it seeks to reach, when it wheels upwards,

and alights at about a third of the height which it was from the ground on the tree which it left, the distance between the trees being perhaps 50 feet.

FLY-POWDER is the name given to a compound of metallic arsenic and arsenious acid, obtained by the partial oxidation of the metal, on exposure to air, and which is sold on the continent for the purpose of killing flies.

FLY-TRAP. See DIONÆA.

FLY-WHEEL, a large heavy wheel applied to a steam-engine or other machinery in order to equalize the effect of the moving power. Its action depends upon the principle, that a body once set in motion retains a certain amount of moving force or *momentum.* This increases with the weight of the body and the velocity of its motion, and may be expressed relatively by multiplying the weight by the velocity; or stated otherwise, the force required to destroy the motion of a body is equal to that which set it in motion. Thus, a heavy wheel becomes a sort of reservoir of force, when set in motion.

The are two principal cases in which the fly-wheel is commonly applied: first, when the motive power is intermittent or irregular; and second, when the resistance or work to be done is intermittent or irregular. The crank is a good example of the first case. If the force be applied only downwards, as in the common foot-lathe, it will be intermittent, and the crank must rise independently of the prime mover. This is effected by applying a fly-wheel, which is set in motion by the descending pressure of the foot acting upon it through the crank; and the momentum it has thus acquired lifts the crank again to the point where it can be acted upon by the foot. It also carries the crank over the *dead points* (see CRANK), where even a double action of pulling and pressing would be ineffective. The case of a steam-engine turning a long shaft which passes through several workshops, and by means of bands drives a number of lathes, punching, drilling, planing machines, etc., is a common example of the second case, the resistance or work to be done being very variable from one moment to another. In such work as that of a punching-machine, the engine need not be nearly of sufficient power to directly force the punch through the metal, and yet by the aid of the fly-wheel it may do it; for while the punch is rising, the engine is communicating momentum to the fly-wheel; and when the descending punch meets with the resistance it has to overcome, this reserved momentum is added to the direct power of the engine, the punch is forced through, and the speed of the fly-wheel slackened, in proportion to the resistance.

The principle of the fly-wheel is sometimes applied in other forms than that of a wheel, as in the hand-coining press, where a heavy ball is fixed at each end of a long lever, which is made to swing round with considerable velocity, and the accumulated momentum is concentrated upon the blow.

FO. See BUDDHA.

FOCHABERS (of old, *Fochobyr*, and still locally styled *Fochaber*), a small, neat village and burgh of barony on the right bank of the Spey, in Morayshire. Pop. '71, 1227. The parish church stood formerly at Bellie, in Banffshire, about 2 m. nearer Speymouth, and in the immediate neighborhood of an old encampment, which has been supposed to be the Tuessis of Ptolemy. Gordon castle, the old "Bog of Gight," formerly the seat of the duke of Gordon, now the duke of Richmond, stands between F. and the Spey. F. has a valuable system of free schools, founded by a bequest of about £20,000 by Alexander Mylne, a native of the town. The site of F. is peculiarly fine, lying as it does at the mouth of a picturesque ravine, watered by a mere rill falling into the rapid Spey, but swelling in times of flood into a wider stream than that which it feeds.

FOCIME'TER. See CLAUDET'S FOCIMETER.

FOCUS. Certain points in the ellipse, hyperbola, and parabola are called foci. See ELLIPSE, HYPERBOLA, and PARABOLA. Focus, in optics, is a point in which several rays meet and are collected after being reflected or refracted, while a *virtual* focus is a point from which rays tend after reflection or refraction. The principal focus is the focus of parallel rays after reflection or refraction. See LENS, MIRROR, and CATOPTRICS and DIOPTRICS.

FODDER, (Ger. *futter*, Anglo-Sax. *foddor*), the food collected by man for the use of the domestic herbivorous quadrupeds. In English, the term is commonly restricted to dried herbage, as hay and straw; but in other languages, it is more comprehensive, and includes all the food of cattle, except what they gather for themselves in the field.

The principal part of the food of all the domestic herbivora is furnished by grasses, almost all of which are eaten by them when fresh and green. Besides the supplies which they receive of all the kinds of corn cultivated for human food, they are also, to a considerable extent, dependent on the *straw* or dried herbage of the corn-plants for their winter provender; and that of many other grasses, cultivated on this account alone, is converted into *hay* for their use. Hay, being cut and rapidly dried whilst the plant is still full of sap, contains more nutritious matter than the ripened straw of the cereals. The most important fodder grass of Britain is RYE GRASS, next to which must be ranked TIMOTHY GRASS; but all the meadow grasses and larger pasture grasses also contribute to the supply of hay.

Next to the grasses must be ranked different kinds of *leguminosæ*, affording food for cattle in their seeds—as beans, pease, lentils, lupines, etc.—and in their herbage, on account

of which many of them are cultivated, as clover, medick, melilot, vetch, tare, sainfoin, etc., of some of which there are numerous species. Some of these also often enter pretty largely into the composition of hay, being cut and dried with the grasses along with which they have been sown; which is the case also with some plants of other orders, as the ribwort plantain, etc. Some of the *cruciferæ* are cultivated to a considerable extent as forage-plants, cattle being fed on their green herbage, although they are not suitable for drying as fodder. Among these are kale and cabbage, rape, etc.

In some parts of the world, cattle are not unfrequently fed on the leaves of trees, as in the Himalayas, where the leaves of different species of *aralia*, *grewia*, elm, and oak, are chiefly employed for this purpose, and are collected, dried, and stacked for winter fodder.

Roots, although not F. in the English sense, must here be mentioned as constituting a large part of the food provided for cattle, particularly those of the potato, turnip, mangold, and carrot, and to some extent also those of the parsnip and Jerusalem artichoke.

FODDER, in law. It is generally considered to be implied in the rules of good husbandry that the hay and straw produced by the farm shall be consumed on it. In England, "in the absence of any agreement respecting the removal of hay and straw, the right to do so is regulated by the custom of the country."—Woodfall, p. 537. The custom differs not only in different counties, but in different parts of the same county. In the narrower sense of F., in which it is used to signify hay or straw that has been already used for bedding cattle, or the like purpose, there seems to be no question that it must be retained on the farm. "Whatever question there may be with respect to hay and straw, as before noticed, all the litter, *fodder*, dung, manure, and compost, must invariably be consumed on the lands; indeed, if this is not expressly provided for by the terms of the contract, it is always implied, as a removal would clearly be a breach of good husbandry."—*Ib.* Where the outgoing tenant leaves F. on the premisis, he is entitled to no compensation, except under an express stipulation. In Scotland, where the rules of good husbandry are more strictly attended to, the tenant must consume the whole of the F. produced by his lands, except the hay and straw of his outgoing crop, and the same rule is applicable to assignees and sub-tenants. In some counties, F. used for making dung is considered steelbow (q.v.), and given to the incoming tenant; but this is usually regulated by express stipulation in the lease. "At one time," says Mr. Hunter, "it was held that a tenant had a right to dispose of the straw of the away-going crop, although the lease bore a general clause, binding him to consume the straw on the farm during the lease. But the rule now is, that where there is an express stipulation that all the manure, hay or straw, shall be used or left, it is strictly interpreted, without control from local usage; and the tenant is not entitled to take away or sell, or have value for the straw of the last or away-going crop."—*Landlord and Tenant*, ii. p. 461.

FODDER, GREEN. See ENSILAGE.

FŒ'TUS, the term applied in medicine to the mammalian embryo, especially in its more advanced stages. In the human subject, we usually speak of the embryo at and after the end of the fourth month as a fœtus.

There are several points in relation to the F. which are of great interest both to the physiologist and to the medical jurist. It is frequently of great importance in medico-legal inquiries to be able to ascertain the *age* of the F.; and to facilitate such determination, the physical characters which it presents at different ages have been carefully noted and described.

In the F. of nine months—the full term—the length is from 17 to 21 in.; weight from 5 to 9 lbs., the average being about 6¼ lbs. Even at birth, the average length and weight of the male infant slightly exceeds that of the female. From numerous observations made by Quetelet, it appears that there is an average excess of length of 4.8 lines, and of weight of 12 ounces, in the male infant.

The average weight of infants, without regard to sex, was found by a French observer, Chaussier (who noted the weight in more than 20,000 cases), to be about 6.7 lbs.—the maximum being 11.3, and the minimum 3.2 lbs. From the inquiries of Dr. Joseph Clark (*Philosophical Transactions*, vol. 76), which were made on 60 males and 60 females, the average in this country seems rather higher, the weight of males being 7 lbs. 6 oz., and that of the females being nearly 6 lbs. 12 oz.; and sir James Y. Simpson arrived at very nearly the same result. Clark observes that if, at the full time, the weight of the infant is less than 5 lbs., it rarely thrives. Various instances are recorded of infants in which the weight at birth has exceeded twice the average weight. Thus a case is recorded by Mr. Owen, in the *Lancet* for 1838, in which the child at delivery weighed 17 lbs. 12 oz., and was 24 in. in length; and in the *Medico-Chir. Review*, Oct., 1841, there is the mention of a case in which the weight was nearly 18 lbs.

There are certain points in which the F. at the full period differs anatomically from the child shortly after birth. The bony skeleton is very incomplete, cartilage occurring in the place of many bones. Indeed, complete ossification (viz., of the vertebræ) is not finished until about the 25th year, and the only bones completely ossified at birth are the minute ossicles of the ear. The difference between the F. and the child in this respect is, however, only one of degree.

During pregnancy, a temporary organ, termed the placenta (popularly known as the after-birth, from its being thrown off shortly after the birth of the child), is developed on the inner wall of the uterus. This organ is mainly composed of vessels, and there proceeds from it the structure known as the umbilical cord, in which lie the umbilical vein, which conveys arterial blood to the F., and the two umbilical arteries, which return the blood to the placenta This umbilical cord conveys these vessels to the umbilicus, or navel. Before tracing the course of the blood through the F., we must notice the chief anatomical peculiarities presented by the vascular or circulating system before birth.

1. In the heart, we find a communication between the two auricles by means of an opening termed the *foramen ovale.* 2. In the arterial system, we have to notice first, the *ductus arteriosus*, which is a large communicating trunk between the pulmonary artery and the descending aorta; and, secondly, the branches given off by the internal iliac arteries, which go under the name of hypogastric as long as they are within the body of the F., and of umbilical when they enter into the structure of the cord, are continued from the F. to the placenta, to which they return the blood which has circulated in the fœtal system. 3. In the venous system there is a communication between the umbilical vein and the inferior vena cava, called the *ductus venosus.*

Pure blood is brought from the placenta by the umbilical vein, which passes through the umbilicus, and enters the liver, where it divides into several branches, which are distributed to that viscus, the main trunk or *ductus venosus*, passing directly backwards, and entering the interior vena cava. The pure blood here becomes mixed with the impure blood which is returned from the lower extremities and abdominial viscera, and is carried into the right auricle, and from thence, guided by the eustachian valve (which is situated between the anterior margin of the inferior cava, and the auriculo-ventricular orifice, and is of relatively large size in the F.), passes through the *foramen oval*, into the left auricle. From the left auricle, it passes into the left ventricle, and into the aorta, whence it is distributed by the carotid and subclavian arteries principally to the head and upper extremities, which thus receive comparatively pure blood. From the head and arms, the impure blood is returned by the superior vena cava to the right auricle; from the right auricle, it is propelled, as in the adult, into the right ventricle; and from the right ventricle, into the pulmonary artery. In the adult, it would now pass through the lungs, and be oxygenized; but in the F., it passes through the *ductus arteriosus* into the commencement of the descending aorta, where it mixes with that portion of the pure blood which is not sent through the carotid and subclavian arteries. Some of this mixed blood is distributed by the external iliac arteries to the lower extremities, while the remainder (probably the larger portion) is conveyed by the hypogastric or umbilical arteries to the placenta.

From the above description we perceive—1. That a considerable quantity of the pure blood from the placenta is at once distributed to the liver, which accounts for its large size at birth as compared with the other viscera. 2. That a double current meets in the right auricle, one stream, guided by the eustachian valve, passing through the *foramen ovale* into the left auricle, the other through the auriculo-ventricular opening into the right ventricle. 3. That the comparatively pure blood sent to the head and arms, as contrasted with the impure blood sent to the lower extremities, causes relatively greater development of the former organs, and prepares them for the functions they are called upon to perform; the development of the legs at birth being slight as compared with that of the head or arms.

Almost immediately after birth, the *foramen ovale* becomes closed by a membranous layer, and the *ductus arteriosus* and *ductus venosus* degenerate into impervious fibrous cords.

The lungs, previously to the act of inspiration, are dense and solid in structure, and of a deep-red color, and lie far back in the chest. Their specific gravity is greater than water, in which they (or portions of them) consequently sink, whereas lungs, or portions of lungs, that have respired, float in that fluid.

In the preceding remarks, we mentioned *nine months* as the full period of fœtal existence. The period of gestation is, however, only constant between certain limits, and it is of the greatest importance in reference to questions of chastity and legitimacy to determine these limits.

The average duration of gestation in the human female is comprised betwen the 38th and 40th weeks after conception. It is comparatively seldom that the actual date of conception can be fixed with positive certainty; but amongst the few cases of this kind on record, Rigby mentions one in which natural labor came on in 260 days, and Reid mentions another in which it did not commence until the lapse of 293 days. Here, then, we have an unquestionable range of 33 days; and many apparently authentic cases are on record in which a longer period of gestation than in Reid's case has been observed.

Another important question in connectien with this subject is—What is the earliest period at which a child can be born, to enable it to live, and to continue in life after its birth? There is no doubt that children born at the seventh month of gestation are capable of living, although they usually require much care; and children may be born alive at any period between the sixth and seventh months, or even in some instances

earlier than the sixth; but this is rare, and if born living, they commonly die soon after birth. Various cases of this nature are collected by Dr. Taylor in his *Medical Jurisprudence;* amongst others, he mentions a case reported by Dr. Barker of Dumfries, in which a child was born at the 158th day of gestation, and (though small) grew up. In the celebrated Kinghorn case, the child was born 174 days, or nearly six calendar months after marriage, and lived for more than eight months; and the majority of the medical witnesses who gave evidence on that occasion were strongly in favor of the view that the period of the gestation was circumscribed by the period of wedlock.

Again, questions connected with prolonged gestation have given rise to much discussion in legal médicine. No period has been fixed by law beyond which a child if born in wedlock is to be declared illegitimate. In the case of Anderton *v.* Gibbs, 1834, the vice-chancellor decided that a child born 10 months or about 42 weeks after intercourse with the husband, was legitimate. In the Gardner Peerage case, which came before the house of lords in 1825, the question was, whether a child born 311 days (or 44 weeks and 3 days) after intercourse could be legitimate. Lord and lady Gardner separated on the 30th of Jan., 1802, and did not again meet till the 11th of July. A full-sized child was born on the 8th of Dec. of that year. The principal obstetric practitioners in the kingdom were examined on this point, and a large majority concurred in the opinion that natural gestation might be protracted to such a period. The decision, which was against the legitimacy, seems to have been mainly if not entirely based on the moral grounds that lady Gardner, after separating from her husband, was living in open adultery. In the case of Commonwealth *v.* Porter (see *American Journal of Medical Science*, 1845), it was decided in the United States that a child born 317 days (or 45 weeks and two days) after conception was legitimate. In the case of Cotterall *v.* Cotterall, decided in the consistory court in 1847, the husband had proceeded against his wife for a divorce on the ground of adultery. In this case, if it were the child of the husband, it must have been born after 12 months' gestation. Dr. Lushington, without entering into the question of protracted gestation, at once pronounced for the divorce, such a duration of pregnancy not being supported by any known facts.

This article would be imperfect without a notice of the question—What constitutes live-birth? This is a point on which the most distinguished obstetric authorities have differed: some holding that where there is muscular movement, there is life; while others maintain that where respiration has not been proved to have taken place, the child was still-born. Amongst the most celebrated lawsuits bearing on this point, we may mention that of Fish *v.* Palmer, tried in 1806, and that of Brook *v.* Kellock, tried in 1861. In the last-named case it was decided by the vice-chancellor, sir J. Stuart, that a child may live for some time after birth, and not breathe, the absence of signs of breathing being held to be no proof of its being born dead. It was given in evidence that there was pulsation of the funis after separation of the cord, and the beating of the heart was regarded as proof of live-birth. Hence we may regard it as now established in English law, that respiration is not required to establish live-birth. Nor do the laws of France or the United States require that the child shall have breathed. In Scotland, the law requires not only that the child shall have breathed, but that it shall have cried; and in conformity with this law, a child which lived, breathed, and died in convulsions at the end of half an hour, was declared to have been born dead (Dyer's *Reports*, 25).

FOG, or MIST, is the visible watery vapor sometimes hanging near the surface of the earth, and caused, as clouds are, by the precipitation of the moisture of the atmosphere. This takes place when a stratum of atmosphere comes in contact with a colder stratum, or with a portion of the earth's surface, as a hill, by which it is cooled, so that it can no longer hold in solution as much moisture as before. It takes place also when a cold stratum of atmosphere comes above a moist warm portion of the earth's surface, the exhalations from which are precipitated and become visible as they ascend into it. Thus, fogs are formed over lakes, rivers, and marshes in the evening, because the water is then warmer than the atmosphere above it. The fogs seen in the morning very often disappear by being dissolved in the atmosphere as the temperature increases.

FOG, or MIST (*ante.*) On the Atlantic coast of America fogs are frequent, and are for the most part caused by the varying temperature of the ocean currents. The cold current coming down Baffin's bay is by the revolution of the earth thrown against the coast from Newfoundland down to cape Hatteras, where it passes under the gulf stream which runs w. of it, but in an opposite direction. The gulf stream, that vast body of warm water from the tropics, heats and saturates with moisture the air under which it passes. When the wind is in a direction to drive this warm moist air over the cold current, the moisture condenses into fog and is blown inland. Therefore an e. or s.e. wind will bring fogs along the coast of the eastern states and Newfoundland. Further towards the s. only an e. wind will bring these fogs. The same holds good on the Pacific coast, where there is a corresponding cold stream near the shore and a warm stream further out. Fogs are brought to Oregon and California by w. and n.w. winds.

FOG'ARAS, a co. in Transylvania, e. Austria, on the frontier of Roumania; pop. of the old district, '70, 86,943; the larger portion of whom being Wallachians, the remainder Hungarians and Saxons. The surface is mostly mountainous, and the climate is cold and unfavorable to agriculture. Cattle-raising is the principal business.

The district was changed into a county in 1876. The capital, FOGARAS—pop. 67, 4,714—is on the Aluta river, 32 m. w.n.w. of Cronstadt. It has a strong castle, dating from the 14th c., and restored 300 years later.

FOGARASY, JÁNOS (JOHN), a Hungarian philologist and jurisconsult, was b. in 1801 at Käsmárk, in the co. of Abanj. F. went through the study of philosophy and law at the Calvinistic college of Sárospatak, and was called to the bar in 1829. Upon entering the judicial career, F. divided his exertions between law and the national or Magyar language, with such success that he was elected fellow of the Hungarian academy in 1838. F.'s several publications in the fields of Hungarian jurisprudence and philology are reckoned to be standard works, bearing the stamp of deep original research, and of great systematic powers. The following list of works, all published at Pesth, in the Hungarian or Magyar tongue, may show the fertility of F.'s pen: *Latin-Magyar Lexicon for Legislation and Government* (2d ed. 1835); *The Metaphysics of the Magyar Tongue* (1834); *Magyar-German Dictionary* (1836); *Elements of Hungarian Statute Law* (1839), with a valuable appendix published at a later date; *The Commercial Law of Hungary* (1840); *Hungarian Bank* (1848); and *Commercial Dictionary*. F. has also contributed much, by his *Essays on the Spirit of the Hungarian Language* (1845), towards its rapid development. To him and to Czuczor we are indebted for the great dictionary of the Hungarian academy, of which five volumes had appeared in 1866.

FOGELBERG, BENEDICT ERLAND, 1786–1854; a Swedish sculptor, son of a copper-founder. He studied art in Stockholm, where he was much influenced by the sculptor Sergell. In 1818, he went abroad, and studying in Paris and Rome, passed nearly all the remainder of his life in the latter city. He at first selected his subjects from classic mythology; but in later life the weird myths of Scandinavia had great charms for him, and appeared in his statues of "Odin," "Thor," and "Balder." His portraits and figures, such as "Gustavus Adolphus," "Charles XII," and "Birger Jarl," are faithful and dignified works.

FOG'GIA, or CAPITANA'TA, a province in s. Italy, on the Adriatic, intersected by the railroad from Bologna to Otranto; 2,955 sq.m.; pop. 72, 322,758. It is divided into three districts. The peninsula of Gargano extends e. into the Adriatic. The Gargano mountains extend along the e. part of the province, and in the s.w. are spurs of the Apennines. Between these mountain chains are broad and fertile valleys. The rivers are not large. The productions are olives, grapes, grain, tobacco, flax, cattle, sheep, etc. Capital, Foggia.

FOG'GIA, a t. of Italy, capital of the province so named (formerly Capitanata), in southern Italy, is situated between the rivers Cervaro and Celone, in a district abounding in plantations of olives, vines, and other fruit trees, 80 m. e.n e. of Naples. It is a handsome, well-built town, with spacious streets, good houses, and large shops. Among the chief buildings are the cathedral, a Gothic edifice originally, but partially destroyed by an earthquake in 1731, and afterwards rebuilt in a different style; numerous churches, some of them antique; the custom-house, a beautiful building; and the theater. It is the center of all the trade of the province, and has many large corn magazines. Pop. '72, 38,188.

F., supposed to have been built from the ruins of the ancient Arpi, was a favorite residence of the emperor Frederick II., and here died his wife, Isabella, daughter of the English king John. It was also for some time the residence of Ferdinand I. and his court, when it ranked as the second city in the kingdom.

FOGO, or FUEGO, one of the Cape Verd islands w. of Santiago; about 40 m. in circumference, formed almost entirely of the slopes of a volcanic mountain of 9,157 ft. elevation. The volcano was first known to be in action in 1680, and the last eruption, which was the cause of great destruction, occurred in 1847. The great trouble is the lack of water, droughts being sometimes so protracted as to cause famine. Ordinarily the island is exceedingly fruitful. Chief town and port, Nossa Senhora da Luz.

FOG-SIGNALS, audible warnings used on board ships, on the sea-coast, or on railways, during fogs and mists, or at any other time when lights or ordinary daylight-signals are not available.

The commonest fog-signal on shipboard is the continuous ringing of the ordinary time-bell, or striking the anchor with a hammer, together with the occasional discharge of musketry and heavy guns. These are adopted, to prevent collisions, when ships are overtaken by a fog in the British channel, or other places where shipping is abundant. The blowing of a horn, the beating of a drum, an empty cask, a gong, and various other unusual sounds, are also adopted. Steam-vessels generally blow a whistle under these circumstances. These sounds, however, only indicate rudely the position of the ship, and not the direction in which she is sailing. Many plans have been devised for a code of signals, by which the directions n., s., etc., might be indicated by the varying length of each sound, or the intervals between the sounds of a fog-horn or whistle.

It is very desirable that some general code of signals of this kind should be adopted for the merchant service as well as the navy; and that its recognition by the marine of all other nations should be procured. The admiralty have such a code for the direction of

a fleet of ships of war in thick weather, but their application is limited to the navy. Some further remarks on fog-signals will appear under signals (q.v.).

Fog-signals from the shore are very desirable, especially on a dangerous coast. Bells and guns have both been used for the purpose, but when a strong wind is blowing in towards the shore, their sound is heard only at a very little distance out to sea. Consequently steam-whistles, and fog-horns sounded by compressed air, are being employed in their stead.

The fog-signals used on railways are small cases charged with detonating powder, and laid upon the rails. They explode loudly when the wheel of an advancing train comes upon them. They are not merely used in fogs, but in all cases of danger, from obstruction of the line, or in other cases of urgency when a train has to be stopped without delay. Station-masters and railway police are furnished with them for the purpose of thus stopping a train at any place.

FOG-SIGNALS (*ante*). The importance to navigation along the coast of the United States of these signals, has led to many experiments and improvements. The bells, gongs, guns, etc., used on board ship are little depended upon; but instead, there have been placed at many points on the coast, whistles and horns of great power, which are sounded at frequent intervals when the state of the atmosphere requires it. The simplest and commonly most powerful signal employed by the light-house board, is the locomotive whistle, operated by a steam boiler with a pressure of 50 to 75 lbs. The sounds from the land are distinguished from those on board ship by the length of the notes and the intervals between. The whistles are from 8 to 10 in. in diameter, and are operated automatically. The Daboll trumpet, which is worked by air condensed by a caloric engine, is next in importance. This trumpet itself provides the resounding cavity, and the vibratory motion of the air is produced by a reed. This reed is an iron bar, the larger trumpets being 18 in. long, 2 in. wide, and three quarters of an inch thick, gradually lessening towards the free end. A pressure of 15 lbs. to the sq.in. is the highest power employed. This trumpet is especially valuable in places where water is not procurable, because its motive power is hot-air. The most powerful instrument yet employed as fog signal, is that known as the siren trumpet. The impulse to the air which produces the sound is given by a flat drum, or a hollow cylinder with a short axis, one end of which is perforated to admit the steam from a pipe connected with a locomotive boiler. On the other side the drum is also perforated with eight holes, in connection with which is a revolving disk, which is, in its turn, provided with the same number of holes. As the disk revolves, these eight holes are alternately opened and shut, allowing egress to as many gusts of steam, which in turn, produce a violent movement of the air, giving rise to a most powerful sound, reinforced by the resonance of a trumpet of suitable length. The requisite velocity is communicated to the disk by an engine attached to a boiler. The sound from this instrument can be heard in still air at a distance of from 20 to 30 m., even during a dense fog. This trumpet is worked by a pressure of 75 lbs. of steam in an ordinary locomotive boiler. But, although these sounding horns are very powerful, there is always an amount of uncertainty in the results. The trumpet of which one note may be heard 20 m. off may send the next note less than two thirds the distance. Sound travels in the quiet, dry open air at mean temperature, at the rate of about 750 m. per hour, and an opposing or crossing wind, traveling 10 m. an hour, seriously disturbs and retards the transmission of sound. The intervention of rain, mist, or fog will also disturb and retard; and temperature has a very distinct influence. Add to these disturbing causes, the fact that no two men hear exactly alike, and the uncertainty of dependence upon sound is apparent.

FÖHR, one of the greater of the islands in the North sea, on the western coast of the province of Slesvig; its central point is in lat. 54° 42′ n., and in long. 8° 30′ east. It has an area of about 28 sq.m., has about 5,000 inhabitants, and is divided into *Osterlandfohr*, which always belonged to Slesvig, and *Westerlandfohr*, ceded by Denmark to Slesvig in 1864. The inhabitants are mostly Frisians, who live by taking fish and wild fowl, and by the manufacture of cheese and stocking-ware. The chief place is a bathing-place, called Wyk, with a pop. of 1000.

FOIL, a thin bar of elastic steel, mounted as a rapier (q.v.), but without a point, and additionally blunted at the end by the presence of a button covered with leather. It is used in fencing (q.v.).

FOIL (from *folium*, a leaf), a general name for thin metal intermediate in thickness between *leaf-metal*, such as gold, silver, and copper leaf, and *sheet-metal*.

There are two distinct kinds of F. in common use—the tin-foil used for silvering looking-glasses, lining tea-caddies, and other similar purposes, and for the conducting coatings of electrical apparatus; and the bright foils employed by the jewelers for backing real or artificial gems, and thereby increasing their luster or modifying their color.

The former is made by rolling out tin, or, more recently, by the method of Mr. Wimshurst, who casts a cylinder of the metal, and then, by means of a knife or cutter, shaves it into a sheet as the cylinder rolls to the knife, which is gradually moved inwards towards the axis of the cylinder at a rate proportionate to the required thickness of the sheet.

The bright F. used by jewelers and for theatrical and other ornaments under the

name of "tinsel," is made of copper, tin, tinned copper, or silvered copper. The last is now chiefly used by jewelers. The metal is rolled in a flatting mill, and the requisite brilliancy of surface is produced by finishing between burnished rollers and polishing. The various colors are produced by coating the white metal with transparent colors mixed in isinglass size. A similar varnish without color is laid over the white F., to prevent tarnishing. The socket or setting in which the stone or paste is mounted is lined with the F., and by reflecting from the internal facets the light which passes through the stone, adds considerably to its brilliancy. The natural colors of real stones are sometimes heightened or modified by colored F., and factitious colors are thus given to the glass or "paste," as it is called, of which spurious gems are made.

There are two other methods of foiling gems, distinct from the above: one of them is to line the socket of the setting with tin-foil, then fill it whilst warm with mercury; after a few minutes, the fluid mercury is poured out, and there remains an amalgam of tin, precisely the same as is used for backing common mirrors; the gem is fitted into this, and thus its back has a mirror surface. The other method is to precipitate a film of pure metallic silver upon the back of the stone, by submitting a solution of the ammonia nitrate of silver in contact with the stone to the reducing action of the oils of cassia and cloves. The silvering of looking-glasses being the chief use to which the ordinary *tin-foil* is applied, its purity is a matter of great consideration; its employment also by chemists, as a ready means of forming some of the tin compounds, renders this absolutely necessary.

Nevertheless, the spirit of adulteration has extended to the tin-foil makers, and lead has been extensively alloyed with the tin. In some analyses recently made, it has been shown that as much as 85 per cent of the adulterant metal has been used, the effect of which in the process of silvering mirrors is most injurious to the brilliancy of the amalgam, which should consist of perfectly pure tin and quicksilver. For chemical purposes, it is now absolutely necessary to test for lead before using *tin-foil.*

The foils used by jewelers for backing gems, consisting of small sheets of silvered copper rolled very thin, are colored with the following preparations, to suit the different gems under which they are to be placed, or for use as tinsel in the manufacture of theatrical ornaments, toys, etc. Lake and Prussian blue, and pale drying-oil finely ground with a slab and mullar—for *amethyst* color. Prussian blue, similarly prepared—for *sapphire* color. Dragons' blood dissolved in pure alcohol—for *garnet* color. Sesquiferrocyanide of iron and bicromate of potash, equal parts very finely ground and sifted, then ground with a quantity of gum-mastic equal to the other two ingredients, until the whole forms an impalpable powder; gradually form this into a thin paste with pure wood-spirit (pyroxylic) and preserve in stoppered bottle; when used, a portion is diluted with wood-spirit to the necessary thinness—for *emerald* color. *Various shades of yellowish or bluish green can be produced by varying the proportions of the two coloring materials.* Lake or carmine ground in solution of isinglass—for *ruby* color. A weak solution of orange shellac, sometimes tinted with saffron, turmeric, or aloes—for *topaz* color. Several other color-varnishes are made by similar methods for various shades of tinsel and gem foils. See SILVERING.

FOIX, a small and unimportant town of France, in the department of Ariège, and on the left bank of the river of that name, 44 m. s.s.e., of Toulouse. It has a picturesque old castle, with three well-preserved towers of whitish marble, all of different ages, and all dating from before the 15th century. It has some trade in iron, and in the vicinity are numerous iron-works. Pop. '76, 5,127. F. was capital of the old county of *Foix.*

FOIX, an old French family, which took the title of count from the district of F. (now the department of Ariège), in the s. of France. The first who bore the title was Roger, comte de F., who flourished in the middle of the 11th century. Raymond, comte de F., figures as one of the knights who accompanied king Philippe Auguste to Palestine; afterwards, being accused of heresy, his estates were seized by comte de Montfort. He died in 1223. Several members of the family subsequently distinguished themselves in the wars against England. Gaston III., comte de F., born 1331, and called, on account of the beauty of his person, Phœbus, was noted for his knightly love of splendor and military prowess. For his services to the king, he was made governor of Languedoc and Gascony. When only 18, he married Agnes, daughter of Philip III., king of Navarre. In 1358, during the insurrection known as the *Jacquerie* (q.v.), he delivered the royal family from the power of the rebels. When Charles VI. wished to deprive him of the government of Languedoc, he maintained his position by force of arms, and defeated the duc de Berri in the plain of Revel. He was inordinately attached to the chase, and is said to have kept 1600 dogs. He also wrote a work on the subject, entitled *Miroir de Phébus des deduitz de la Chasse des Bestes sauvaiges et des Oyseaulx de Proye,* which went through several editions in the 16th and 17th centuries, and whose bombastic style (*faire du Phébus*) became a byword. Froissart owed some of the choicest incidents in his history to having lived for some time in the castle of Orthes, Gaston's principal residence. After his death, in 1391, the estates and title went to a collateral branch of the family. Gaston IV., comte de F., rendered good service to the king in the wars against England. In 1455, his father-in-law, John II.,

king of Navarre, named him his successor. In addition to this, Charles VII. created him a peer of France, and ceded to him his claims upon Roussillon and Cerdagne. He died in 1472, when the family possessions were again divided. The last, his grandson, Gaston de F., was probably the most heroic member of the family. Son of Jean de F., comte d'Estampes, and Marie d'Orléans, sister of Louis XII. of France, he was born in 1489, and in 1507 received from his uncle, the French king, the title of duc de Nemours. In the Italian wars carried on by Louis, Gaston displayed the most brilliant and precocious genius. He twice overthrew the Swiss, at Como and Milan; chased pope Julius II. from Bologna; seized Brescia out of the hands of the Venetians, and, to crown a series of splendid triumphs, which obtained for him the title of the *Thunderbolt of Italy*, won the great battle of Ravenna over the Spaniards, 11th April, 1512, in which, however, he fell, at the early age of twenty-three. On his death, the estates and title of the house of F. went to Henri, king of Navarre, whose daughter, Jeanne d'Albret, married Antoine de Bourbon, duc de Vendôme, and became the mother of the great Henri Quatre, who thus attached the county of F. to the French crown.

FOIX, PAUL DE, 1528–84; a French prelate and diplomatist; studied in Paris and Toulouse, and lectured on civil law. At the age of 19, he became a councilor of the *parlement* of Paris. In 1561, he was ambassador to England; and in 1565, he vainly endeavored to persuade Elizabeth to consent to the surrender of Havre to the French He was afterwards sent to negotiate a marriage between Elizabeth and the duke of Anjou. On account of his previous toleration of the Lutherans, he narrowly escaped perishing in the massacre of St. Bartholomew; but the following year, being intrusted with an embassy to Italy, he had an audience with the pope and fully established his orthodoxy. In 1576, he became archbishop of Toulouse. He was afterwards intrusted by the French king with various important missions, and in 1579 was appointed ambassador to Rome, where he died.

FOKIEN, a province in s.e. China bordering on the Formosa channel, Pacific ocean; 53,480 sq.m.; pop. 22,799,556. Several islands are included in the province. The country is mountainous, but is highly cultivated and unusually fertile. The products are tea, rice, wheat, barley, sweet potatoes, tobacco, sugar, camphor, indigo, alum, etc. There are manufactures of cloths and porcelain. Capital, Foo Chow.

FOKTCHA'NY, or FOKTSHAN, a t. of Wallachia, on the Milkov, a branch of the Sereth, 105 m. n.n.e. from Bucharest. The Milkov divides Wallachia from Moldavia, and a large suburb of F. is in Moldavia. In 1789, F. was destroyed by the Russians. It was burned by the Turks in 1822. The inhabitants are mostly Greeks and Jews. Pop. of town and suburb nearly 40,000.

FOLCLAND, or FOLKLAND, the land of the folk or people in England in Anglo-Saxon times. The F., according to Turner, was that portion of the kingdom which was retained in behalf of the public, and with a view to increasing population and the growing wants of the community, and not permitted to become allodial estate, or absolute private property. Of this land, the usufruct or *dominium utile* was enjoyed by the freemen, for which certain rents were paid to the state, and which did not become hereditary. On the contrary the rights which were held in it by individuals reverted to the community at the expiry of a particular term, when it was again given out by the folcgemot or court of the district, either in commonty or in severalty. Certain services to the public were commonly imposed on the holders of F., such as the reparation of the royal vills and other public works; the exercise of hospitality to the king, and to other personages of distinction in their progress through the country, by furnishing them and their messengers, huntsmen, hounds, hawks, and horses with food, and providing them, when necessary, with means of transport. It does not seem that the F. was held exclusively by the common people, but rather that it was open to freemen of all ranks and conditions, and that the possession of it was much coveted even by those who held great estates on the hereditary title which was known as *bockland* (q.v.). F. was often given out as bockland to those who had performed great public services, just as Horatius was rewarded by a grant of the Roman *ager publicus*—

> "They gave him of the corn-land
> That was of public right,
> As much as two strong oxen
> Could plow from morn till night!"

It was also frequently given to the church, for the purpose of founding monasteries and the like, a practice of which Bede complains in his celebrated letter to archbishop Egbert. "It is disgraceful to say, persons who have not the least claim to the monastic character, as you yourself best know, have got so many of these spots into their power, under the name of monasteries, that there is really now no place at all where the sons of nobles or veteran soldiers can receive a grant."—Kemble's *Saxons*, p. 291. Kemble gives examples of the dues paid by monasteries for the F. which they held, which afford curious information as to the products of industry and modes of living of those times. In 883, a monastery is freed from all dues which the monks were still bound to pay to the king's hand, including bright ale, beer, honey, oxen, swine, and sheep. The dues of the monastery at Tauton were—a feorm (or entertainment) of one night to the

king, and eight dogs and one dog-keeper; and nine nights' keep for the king's falconers, and carriage, with wagons and horses, for whatever he would have taken to Curry or Wilton; and if strangers came from other parts, they were to have guidance to the nearest royal vill upon their road.—*Ib.* 295, 296.

FÖLDVAR, or DUNA-FÖLDVAR, a t. of Hungary, in the co. of Tolna, is situated on the crest and slope of a hill on the right bank of the Danube, 48 m. s. of Pesth. It has a Roman Catholic high school, is a steam-boat station, has an important sturgeon fishery, and considerable trade in wines and agricultural produce. Pop. '69, 12,382.

FOLENGO, TEOFILO, 1491–1544; otherwise known as MERLINO COCCAJO or COCAJO, one of the principal macaronic poets of the 16th century. At the age of 18, he became a member of the Benedictine order, and while a monk wrote Latin verses in the style of Virgil. About 1516, he forsook monastic life and wandered round the country, with a young woman of good family, Giorlama Dieda, often in great poverty, as he had no resource but his poetic talent. His first publication was *Merlini Cocaii Macaronicon*, which relates the adventures of a fictitious hero named Baldus. Though coarse and gross, it contained much genuine poetry and became very popular. Folengo's next work was *Orlandino*, an Italian poem of eight cantos composed in rhymed octaves. In the same year (1526) he re-entered a monastery, and in a later poem related the experiences of his vagabond life. He subsequently wrote religious poems, and for a short time assumed the charge of a Sicilian monastery. He is frequently quoted by his great contemporary, Rabelais.

FOLEY, JOHN HENRY, 1818–74; an Irish sculptor who began his work in Dublin, where he took several prizes. He appeared as an exhibitor in 1839, with his "Death of Abel" and "Innocence." In 1840, "Ino and Bacchus" gave him immediate reputation. Among his many works were "Lear and Cordelia;" "Death of Lear;" "Venus receiving Æneas;" "Prospero and Miranda;" statues of Hampden and Selden for the houses of parliament; "Egeria;" "The Elder Brother," (in Comus); "Caractacus;" "Goldsmith;" "Burke;" "Reynolds;" "O'Connell;" "Gough;" "Outram;" "Asia," (a symbolical group, and with it the "Prince Consort" for the Albert memorial in Hyde Park); and "Stonewall Jackson" for South Carolina. The statue of "Outram" is considered his master-piece.

FOLGER, PETER, 1617–90; b. England. In 1635, he settled in Martha's Vineyard, Mass., and in 1663, removed to Nantucket. His daughter Abia was the mother of James and Benjamin Franklin. Folger was the author of the singular work in verse, *A Looking-glass for the Times; or the Former Spirit of New England revived in this Generation.* The writer addressed himself to the governors of the colonies at the time, advocating liberty of conscience, and toleration of the Anabaptists, Quakers, and all sects who had hitherto suffered persecution.

FO'LIA MALABA'THRI, i.e., Malabar leaves, formerly in much repute as a medicine; an aromatic tonic; the dried leaves of *cinnamomum nitidum*, and partly of *C. Tamala*, species of cinnamon, small Indian trees or shrubs.

FOLIA'TION, a term restricted by Mr. Darwin, and subsequently by geologists, to the alternating layers or plates of different mineralogical nature, of which gneiss and some other metamorphic schists are composed. It differs from cleavage, which is applied to the divisional planes that render a rock fissile, although it may appear to the eye quite or nearly homogeneous; and from lamination, which is the easy splitting of a rock into its original layers of deposition. It is difficult to determine the cause of foliation. Some hold that as gneiss is composed of the disintegrated ingredients of granite, the layers are identical with the original laminæ, having been arranged according to their various densities. But it can scarcely be conceived that water would be able to deposit such materials in the same order over areas so immense as those occupied by gneiss strata. It seems more probable that the arrangement is owing to some widespread metamorphic and segregating force, which operated subsequently to the deposition of the beds.

FOLI'GNO, a t. of Central Italy, in the province of Perugia, in the fruitful valley of the Topino, 18 m. n. of Spoleto. It was formerly surrounded by walls, which have now been converted into promenades. It has regular streets, and some important buildings, including the beautiful cathedral, the theater, the palazzo communale, the hospital, and several churches. Raphael's Madonna di Foligno, now in the Vatican, formerly hung in a convent here. Soap and comfits are manufactured, and much silk is produced. Pop. 8,500.

F., the ancient Umbrian *Fulginium*, was called in the middle ages Fulignum. In 1832, it suffered severely from an earthquake.

FOLKES, MARTIN, LL.D., an eminent English scholar and antiquary, b. at Westminster in 1690, was educated at Clare Hall, Cambridge. In 1713, he was chosen a fellow of the royal society of London; and in 1741, he succeeded sir Hans Sloane as president of that learned body. He was also a member of the antiquarian society, and of the royal academy of sciences at Paris. He died in 1754. F. was the author of *A Table of English Gold Coins from the 18th Edward III., when Gold was first coined in England* (Lond. 1736, 4to), with *A Table of English Silver Coins, from the Norman Conquest; to which is added an*

Appendix, answering the Coins minted in Scotland since the Union of the two Crowns (Lond. 1745, folio), published under the care of the antiquarian society, superintended by Dr. Giffard (1763, 2 vols). Besides these works, F. contributed a number of papers to the *Philosophical Transactions.*

FOLKESTONE, a rising t. of England on the s.e. coast of Kent, is a municipal borough, seaport, and bathing-place, and is situated 83 m. e.s.e. of London by rail, and 5 m. w.s.w. of Dover. It stands on uneven ground at the foot of a range of hills. The oldest part lies in a narrow valley, crossed by a magnificent railway viaduct. It has rapidly extended and improved since the opening of the Southeastern railway, and the establishment of steam-packets from this town to Boulogne, 30 m. to the s.e. Between the two places is a submarine chain of rocks only 14 fathoms under low-water. Pop. '71, 12,698. F. unites with Hythe in returning one member to parliament. The harbor is much used by boats employed in the herring and mackerel fisheries. The view from the pier extends from Shakespeare cliff, at Dover, to Fairlight head, at Hastings; the Boulogne heights are also seen. In the vicinity are the remains of Roman intrenchments. Here Harvey, the discoverer of the circulation of the blood, was born.

FOLK-LORE, a term compounded after a German model, and of late used to designate what may be called a department of antiquities or archæology—viz., that which relates to ancient observances and customs, and also ideas, prejudices, and superstitions among the common people. In England, the literature of this subject may be said to have commenced with the *Miscellanies* of John Aubrey, published in 1696, in which we find chapters on Day Fatality, Omens, Dreams, Corpse Candles, Second Sight, and kindred matters, to which that learned but credulous author—an early member of the royal society—had given his attention. Here, however, the superstitions, rather than the ordinary observances and customs of the people, were detailed. The first book addressed to the general subject of folk-lore was an octavo volume by the Rev. Henry Bourne, published at Newcastle in 1725, under the title of *Antiquitates Vulgares, or the Antiquities of the Common People.* It mainly consists of an account of the popular customs in connection with the feasts of the church. Fifty years after its publication, John Brand, M.A., a native of Newcastle, busied himself in extending the collections which originated with Bourne, and in 1777 he published at that city the first edition of his *Observations on the Popular Antiquities of Great Britain,* a work which was subsequently enlarged by himself, partly from the stores of folk-lore presented in the *Statistical Account of Scotland* (edited by Sinclair, 1791–95), but was left to be reissued, under a thoroughly revised form, in 1813 (2 vols. 4to), by Henry Ellis, of the British museum. This work, in which Bourne's was incorporated, has since been twice reprinted, with additions, and might have been regarded as an exhaustive work on the subject, if it had not been shown by Home's *Every-Day Book* and *Year-Book,* Chambers's *Book of Days,* 2 vols., and *Notes and Queries,* that, after all, many curious particulars of English folk-lore remained to be gleaned. Through all these various channels, we now have tolerably ample information on popular festivals of every kind, both those which appear to have originated in pagan times, and those instituted by the Christian church, on all observances connected with the important movements of domestic life, as marriages, sepulture, etc.; on fireside amusements, on superstitions and vulgar errors. What may be called a sub-section of folk-lore has at the same time been amply illustrated in the *Nursery Rhymes,* edited by J. O. Halliwell, and the *Popular Rhymes of Scotland,* edited by Robert Chambers. It is to be observed that, while folk-lore has thus been engaging the attention of literary men, and put beyond risk of oblivion by taking its place in solid books, it is everywhere declining among the people themselves. To this effect, the diffusion of scientific ideas, the disfavor of the clergy for everything connected with the supernatural except religion itself, and the great industrial changes and improvements of the last fifty years, including a greatly increased shifting of the people from one district to another, have all conduced. In the British islands, until recently, no effort had been made to generalize folk-lore for any purpose connected with anthropology, or any other science; but in Germany, as is well known, the learned brothers, Jacob and Wilhelm Grimm, have turned the ancient simple usages and traditions of the peasant's fireside to excellent account in illustrating remote periods of the national history.

FOLKMOTE (a meeting or assembly of the "folk" or people) was the term applied by the Saxons to district meetings generally, though Kemble is of opinion that originally it was the great meeting of the nation, which was afterwards converted into the Witenagemôte, or meeting of the councilors or representatives of the nation (Kemble's *Saxons in England,* ii. p. 194).

FOLKRIGHT, mentioned in the laws of king Edward the elder, is nearly synonymous with the common law, or rather with the rights which the common law confers on the people of England.

FOLLEN, AUGUST (or ADOLF) LUDWIG, 1794–1855; a German poet who studied theology and law, and after leaving college edited the Elberfeld *Allgemeine Zeitung.* He was accused of political plotting and imprisoned for two years. Upon his release he went to Switzerland, taught school, and became a farmer. He wrote many minor poems, a romance in verse entitled *Tristan and Isolde,* and the celebrated *Niebelungenlied.*

He translated the Homeric hymns, and Tasso's *Jerusalem Delivered;* and published a compilation of Latin hymns. He is most favorably known by his *Bildersaal Deutscher Dichtung.*

FOLLEN, CHARLES THEODORE CHRISTIAN, PH.D., LL.D.; 1795–1840; b. Hesse-Darmstadt, Germany; a clergyman and reformer. He was educated at Giessen, where he distinguished himself by his enthusiasm in the cause of liberty, and fell under suspicion of the authorities as a promoter of revolution. In 1814, he joined the army raised to resist Napoleon, but returned to his studies at the close of the campaign. In 1818, he was appointed by the university lecturer on jurisprudence. His advanced views of human rights and his frankness in avowing them brought him into difficulties, and he left Giessen for Jena, where a similar fortune awaited him. He was accused of complicity in the assassination of Kotzebue, and was twice arrested, but after the strictest examination was honorably acquitted. He afterwards found it necessary to take refuge in Switzerland, where he was appointed professor of Latin in the cantonal school at Coire, in the Grisons. This post he was soon forced to resign on account of the alleged anti-Calvinistic tendency of his teaching. He was next appointed lecturer upon law and metaphysics at the university of Basel. The German government demanded his surrender as a revolutionist. This demand was twice refused, but upon its renewal for the third time the Swiss authorities yielded and endeavored to arrest him, but escaping through Paris to Havre, he sailed for the United States, where he was warmly welcomed. In 1825, he was appointed a teacher of German at Harvard college, and, three years later, became teacher of ecclesiastical history and ethics in the divinity school. From 1830 to 1835, he was professor of German literature at Harvard. Later on, he preached in the first Unitarian church of New York city, and in 1839 accepted a call to the pastorate of a church of the same denomination in Lexington, Mass. From the commencement of the anti-slavery movement he was an avowed abolitionist and a warm friend and associate of Garrison. His fearless opinions on this question made him very unpopular in his adopted country, but after suffering banishment from his native land for his love of liberty, he found it difficult to reconcile the American declaration of independence with the systematic enslavement of the negro. He lost his life in the burning of the steamboat *Lexington* on Long Island sound, Jan. 13, 1840.

FOLLEN, ELIZA LEE, 1787–1860; b. Boston; daughter of Sebastian Cabot, and wife of prof. Charles Follen. She was well known in literature as the author of *Selections from Fenelon; Well-Spent Hour; Married Life; Little Songs; Twilight Stories;* and poems and songs.

FOLLETT, Sir WILLIAM WEBB, 1798–1845; attorney-general of England, son of an army officer, completed his education at Cambridge and the inner temple. He commenced practice as a pleader in 1821, and was called to the bar in 1824, going on the western circuit the next year. His success was immediate and his progress rapid. In 1830, he married a daughter of sir Ambrose Harding Gifford, chief-justice of Ceylon. In 1835, he was returned to parliament for Exeter, and soon gained distinction. Under sir Robert Peel he was appointed solicitor-general. In 1835, he was knighted. In 1844, he succeeded sir Frederick Pollock as attorney-general, but his health failing, he was forced soon afterwards to give up practice.

FOLLY ISLAND, off the coast of South Carolina, in Charleston co., extending from Stone river to Lighthouse inlet. It was the scene of some important operations during the war of the rebellion.

FOLSOM, NATHANIEL, 1726–90; b. N. H. He commanded a company at fort Edward in 1755, and served as brig.gen. at the siege of Boston until July, 1775. He was a member of the continental congress for two terms; a councilor, and president of the convention which framed the constitution of New Hampshire in 1783.

FOLZ, or FOLCZ, HANS, b. Germany, 1478. He was one of the famous Minnesingers, and wrote rhymes and dramatic pieces. His lyrics are spirited, graceful, and moral in tone; but some of his prose writings are thoroughly the reverse.

FOMENTA'TION (Lat. *fomentatio;* also *fotus*, from *foveō*, I bathe), an application of warmth and moisture to a part, by means of cloths wrung out of hot water, sometimes medicated vegetable infusions of substances calculated to relieve pain or stimulate the surface. Thus, opium, belladonna, chamomile, turpentine, etc., are used in various forms in connection with fomentations, which are of very great service in the treatment of almost all painful local disorders.

FONBLANQUE, ALBANY, journalist, b. in 1797, was intended for the bar, and became a pupil of Chitty, the eminent special pleader. Castlereagh's six acts made him a political writer. As editor of the *Examiner*, the then leading liberal weekly journal, F. exhibited a singular keenness both of wit and intellect, and exercised no inconsiderable influence on public opinion between the years 1826 and 1836. Leigh Hunt, who was his predecessor in the editorship of the *Examiner*, says of him in his autobiography, "He was the genuine successor not of me, but of the Swifts and Addisons themselves; profuse of wit even beyond them, and superior in political knowledge." The characteristics of his political writings may be gathered from his work, entitled *England under Seven Administrations* (1837), which is simply a reprint of the more historical leading

articles published in the *Examiner* from the period of the Canning and Goderich ministries, to the return of the Melbourne ministry. F.'s services to the whigs were rewarded by his appointment to the office of secretary to the statistical department of the board of trade in 1852. He afterwards became head of the same department, and comptroller of corn returns, which offices he held till his death on 14th Oct., 1872.—See *Life and Labors of A. F.*, by his nephew (1874).

FOND DU LAC is a name of various application in that portion of the United States which originally belonged to French Canada. Primarily denoting the inner extremity of any great body of fresh water, it has, secondarily, been made to indicate adjacent localities of different kinds, chiefly in connection with lake Superior, the grand reservoir of the St. Lawrence, and lake Winnebago, which empties itself from the westward into lake Michigan.—1. The Fond du Lac of lake Superior has lent its appellation to a village in Minnesota, situated at a distance of about 20 m. on its navigable tributary, the St. Louis.—2. The Fond du Lac of lake Winnebago designates both a county and town of Wisconsin. The latter has sprung up mainly since 1845, has a pleasant situation on a wooded slope above the lake, an important trade in grain, provisions, and timber, a great number of artesian wells, and a pop. in 1870 of 12,764.

FOND DU LAC, a co. in s.e. Wisconsin embracing the s. end of Winnebago lake, and all of lake Horicon; intersected by the Chicago and Northwestern, the Sheboygan and Fond du Lac, and the n. division of the Milwaukee and St. Paul railroads, and drained by Horicon river; 752 sq.m.; pop. '75, 50,241. It has a prairie surface with much timber; and the soil is fertile, producing wheat, corn, oats, barley, potatoes, butter, wool, hops, etc. Co. seat, Fond du Lac.

FOND DU LAC (*ante*), a city, the seat of justice of the co. of the same name in Wisconsin; at the mouth of Fond du Lac river where it passes into Winnebago lake; on the Chicago and Northwestern railroad where the Sheboygan and Fond du Lac railroad intersects, and on the Fond du Lac, Amboy and Peoria railroad; 177 m. n.n.w. of Chicago and 63 m. from Milwaukee; pop. '75, 15,308. There is communication by steam-boats through Winnebago lake and Fox river with all the great lakes. The city contains a court-house, an opera-house, a number of halls, a high school, and about 20 churches, embracing 9 denominations. There are also two convents, a female institute, two public libraries, and manufactories of lumber, carriages, flour, paper, machinery, engines, etc. The supply of water is from artesian wells, of which there are more than 1000. There are many fine private residences. The city has a delightful situation, and a very large and increasing trade and manufacturing business.

FONDI (anciently *Fundi*), a small t. of Italy, in the n.w. of the province of Caserta, is situated 6 m. from the coast, on the Appian Way, which now forms its principal street, 56 m. n.w. of Naples. It is an ill-built, dirty, and miserable town, in the neighborhood of a pestiferous lake (the ancient *Lacus Fundanus*); the surrounding plain however (the ancient *Cæcubus Ager*, which produced the famous Cæcuban wine of classic times), is very fruitful. F. is surrounded in part by walls of cyclopean structure, and has a population of 6,740. Its inhabitants were long notorious for brigandage and lawlessness.

FONSE'CA, a bay on the Pacific coast of Central America, lies between the two states San Salvador and Nicaragua. It claims notice principally as the proposed terminus of an interoceanic railway from the Puerto Caballos in Honduras. The intervening country has been surveyed, and reported as favorable.

FONSE'CA, ELEONORA PIMENTEL DE, 1758–99; b. Naples, of an illustrious family, and famous for beauty, learning, and poetical talent. In 1784, she married the marquis Fonseca, and became one of the ladies-in-waiting of queen Caroline of Naples. In consequence of some remarks about the queen's intimacy with one of the ministers, she fell from favor. After the flight of the Neapolitan royal family, the marchioness became a warm partisan of the French, and rendered herself conspicuous by making public addresses in their favor. When the Neapolitan rule was restored the revengeful queen Caroline caused the marchioness to be beheaded, ostensibly on account of her favoring the French.

FONSE'CA, PEDRO DA, D.D., 1528–99; prof. at Coimbra and Evora; sometimes called the "Portuguese Aristotle." He wrote commentaries on Aristotle's works; also a treatise on foreknowledge and freewill. He resided for seven years at Rome, and was the instructor of Molina.

FONT (*Fons Baptismalis*), the vessel used in churches as the repository of the baptismal water. In the early period, while immersion continued to be the ordinary rite of the administration of the sacrament of baptism, the baptistery (see BAPTISTERY), or other place set apart for the ceremony, was furnished with a basin sufficiently capacious to admit of the administration of the rite according to the then prevailing form. But when it became customary to baptize by affusion—that is, by pouring the water on the head of the person to be baptized—the size of the basin was naturally diminished, and eventually it assumed the dimensions and the form which are now familiar to us in most of the mediæval churches in Great Britain and upon the continent. The baptismal F., in its normal form, consists of a basin or cup, more or less capacious, hollowed out

of a solid block, and supported upon a stem or pedestal. It is ordinarily of stone, but some ancient examples of leaden fonts also occur, and a few of copper or of bronze. In general, however, it may be said that the F., in its external form and character, followed the prevailing style of ecclesiastical architecture and ornamentation. From its connection with one of the most solemn rites of religion, it became very early a favorite subject for the exercise of the decorative skill of the artist, and there are still preserved in different churches fonts which exhibit characteristics of each and all the successive fashions through which church architecture has passed since the introduction of the F. in its present form. There is some doubt as to whether any existing specimen in England really belongs to the Saxon period, but examples are found of all the later styles, from the early Norman down to the latest revival of Gothic architecture in our own day; the early English, the decorated, of which a beautiful example occurs in the church of All Saints, Norwich; and the perpendicular, which is seen in its highest perfection at East Dereham, in the same county of Norfolk.

The external figure of the basin of the F. which stands in the church of Swanton, Lincolnshire, erected 1310, seems to have been originally circular or elliptical; but most of the later fonts are hexagonal, or even eight-sided. The basin was commonly supported on a single pillar or stem. Many cases, however, occur in which it rests on three, four, or five pillars, or on a group of pillars or pilasters united into a solid stem. The exterior, as well of the basin as of the pedestal, was often highly decorated, ordinarily with sculpture, but occasionally also in gold and colors; the designs on the basin commonly representing subjects connected with baptism, or its types and symbols. We frequently meet around the pedestal figures of the apostles, sometimes only eleven in number, Judas being omitted.

In the Roman Catholic church, the service of Easter Saturday contains a solemn form for the blessing of the baptismal font. After a long series of prayers, and amid a very imposing ceremonial, the "chrism," or consecrated oil blessed by the bishop, and also the so-called "oil of catechumens," are mingled with the baptismal water, which is reserved for subsequent use. With a view to the preservation of the water thus reserved, the F., especially when it is of porous stone, is sometimes lined with lead; and from an early date, it is furnished with a lid, which is secured by a lock, and is often of a highly ornamental character.

The ordinary place of the F. is at the western end of the nave, near the entrance of the church, but in many cases it stands in a separate chapel or baptistery, or at least in a compartment screened off for the purpose. Even when it stands in the open nave, it is properly inclosed by a rail.

The baptismal F. is not to be confounded with the "holy water fount," which usually stands near the entrance of Roman Catholic churches, and from which persons entering sprinkle their forehead, in recognition of the inward purity with which we ought to enter the house of God; nor with the *piscina* or *sacrarium*, which is found in the chancel or the sacristy of ancient churches, and which was intended to receive and carry away the water used in cleansing the sacred vessels, the altar-linens, and the other furniture used in the administration of the eucharist. See Paley's *Illustrations of Baptismal Fonts;* Simpson's *Series of Baptismal Fonts;* Wetser's *Kirchen-Lexicon;* Binterim's *Denkwürdigkeiten.*

FONTAINE, Jean de la. See La Fontaine, *ante.*

FONTAINE, Pierre François Leonard, 1762–1853, was one of a French family of architects. At the age of 16, he was employed upon government hydraulic works, and he afterwards studied in Paris. During the revolution he was in England. Under Bonaparte he was employed to restore the palace of Malmaison, and afterwards upon various public works down to the time of Louis Philippe. In 1812, he was elected member of the academy of fine arts; and in 1813, became architect to the emperor. In company with Percier he published several works on architecture.

FONTAINEBLEAU, a t. in France, in the department of Seine-et-Marne, is beautifully situated in the midst of an extensive forest, near the left bank of the Seine, 85 m. s.e. of Paris, with which it is connected both by steamers on the Seine, and by railway. There are several fine public buildings, among others, two hospitals—one erected by Anne of Austria, the other by Madame de Montespan. It furnishes a great deal of wine and fruit for the capital, and has manufactures of porcelain. Its grapes are famed as *Chasselas de Fontainebleau.* Pop. '76, 11,545.

F. is chiefly famous for its château, or pleasure-palace of the kings of France, and the forest that surrounds it. The forest covers an extent of 64 sq. m., and presents much fine scenery. The château is said to have originally been founded by Robert the pious toward the end of the 10th century. It was rebuilt in the 12th c. by Louis VII., of whom, and of Philippe Auguste, it was a favorite residence, and was enlarged by Louis IX. and his successors. After being allowed to fall into decay, it was repaired and embellished by Francis I., who here received the emperor Charles V. with lavish splendor, in 1539. Almost every succeeding king added something in the way of enlargement or embellishment, so that it bears the character and style of almost every century.

In the 17th c., it was the residence of Christina of Sweden after her abdication, and

in the *Galerie des Cerfs* she caused her secretary Monaldeschi to be executed. Under Louis XIV. it was occupied by Madame de Montespan, and under Louis XV. by Du Barry; and here pope Pius VII. was detained a prisoner for nearly two years by Napoleon. Many state transactions and treaties are dated from F.; among others, the act of abdication of Napoleon in 1814. Louis Philippe had all the paintings renovated, and the apartments restored in the taste of the 16th century.

FONTA'NA, Domenico, an eminent engineer and architect, b. in 1543, at Mili, in the vicinity of lake Como. At the age of 20 he joined his brother, also an architect in Rome, and in a brief period achieved a reputation sufficiently brilliant to attract the notice of the magnificent cardinal Montalto, to whom he was appointed private architect. The pomp of this cardinal seems to have given umbrage to pope Gregory XII., who, in consequence, discontinued the cardinal's private pensions, and thus disabled him from completing the splendid works he had intrusted to F.—viz., the Sistina chapel in Santa Maria Maggiore, and an adjoining palace. In this emergency, the spirited architect, out of his own funds, carried on the noble designs of his patron, on the same scale of magnificence in which they were commenced, and for his disinterested devotion received later ample reward, when the cardinal, under the name of Sixtus V., was called to the papal chair. F., as papal architect, was employed in a variety of important works, amongst which stands conspicuously the wonderful removal and re-erection of the Egyptian obelisk, to be seen now in the piazza of St. Peter's. He afterwards erected several other obelisks, and was intrusted by Sixtus with the construction of the lateran palace, and of the famous vatican library. The restoration of the columns of Trajan and Antoninus, and the construction of the aqueduct known as the *aqua felice*, deserve mention amongst the many works of utility executed by Fontana. On the death of his friend and patron, pope Sixtus, F., through the intrigues of invidious enemies, was stripped of his post as papal architect in 1592, but was immediately proffered a similar appointment in the name of the king of Naples. During his sojourn in Naples, he executed many imposing designs; the royal palace, and a noble promenade along the bay, being amongst the chief. His conception of a grander harbor was carried into effect by others, his death, in 1607, at Naples, preventing his personal superintendence benefiting the undertaking. F.'s son, Giuglio Cesare, heir to his father's great wealth, and some of his genius, was appointed royal architect on his decease.

FONTA'NA, Felice, a celebrated physiologist, b. at Pomarolo, in the Italian Tyrol, in 1730. At the termination of an elaborate course of study, carried on in the several universities of Verona, Parma, Padua, and Bologna, he was presented to the chair of philosophy in the university of Pisa by Francis I., grand duke of Tuscany. Leopold, on succeeding his father, appointed F. court physiologist, and charged him with the organization of a museum of natural history and physiology, which to this day is one of the scientific marvels of Florence. It comprises a superb collection of the phenomena of the animal, vegetable, and mineral kingdoms, besides an exquisitely elaborate series of wax models, representing the human body as a whole, and each minute separate organ. A similar collection was executed by F. for the museum of Vienna, by order of the emperor Joseph II. He died 9th Mar., 1803. F.'s chief writings consist of scientific considerations on the various phenomena of physical irritability, *Richerche Filosofiche sopra la Fisica Animale* (Florence, 1781); and *Dei Moti dell' Iride* (Lucca, 1765).

FONTA'NA, Lavinia, 1552–1614; daughter of Prospero, and a painter of no little fame, especially in portraits. She was much employed by the ladies of Bologna, and, going thence to Rome, painted the likenesses of many illustrious personages, being under the particular patronage of the family (Bouncampagni) of pope Gregory XIII., who died in 1585. The Roman ladies, from the days of this pontiff to those of Paul V., elected in 1605, showed no less favor to Lavinia than their Bolognese sisters had done; and Paul V. was himself among her sitters. Some of her portraits, often lavishly paid for, have been attributed to Guido. In works of a different kind also she united care and delicacy with boldness. Among the chief of these are a Venus in the Berlin museum; the Virgin lifting a veil from the sleeping Infant Christ, in the Escurial; and the Queen of Sheba visiting Solomon. Her own portrait in youth—she was accounted very beautiful—was perhaps her masterpiece; it belongs to the counts Zappi of Imola, the family into which Lavinia married. She is deemed on the whole a better painter than her father. From him naturally came her first instruction, but she gradually adopted the Caraccesque style, with strong quasi-Venetian coloring. She was elected to the academy of Rome, and died in that city.

FONTA'NA, Prospero, 1512–97; a painter of Bologna, and one of the most distinguished of the Fontana family. He was a pupil of Innocenza da Imola, and upon leaving his studio, worked for some time for Vasari and Pierino del Vaga. From the former he acquired the rapid, and in many instances careless style which distinguished some of his earlier works. He possessed great fertility of imagination, but his mannerism and the inaccuracy of his drawing marred his best efforts. He undertook an immense amount of work, and executed it with rapidity. He is said to have painted an entire hall in the Vitella palace at Cetta di Castello in a few weeks.

He belonged to the same school as Sabbatini, Sammachini, and Passerotti. His greatest successes were in portraiture, in which branch of art he stood so high that towards 1550 Michael Angelo introduced him to pope Julius III. as a portrait-painter; and by this pope he was pensioned, remaining at the pontifical court with the three successors of Julius. He was much respected and considered a sort of arbiter and oracle among his professional brethren. Returning to Bologna, he opened a school of art, in which Lodovico and Agostino Caracci became his pupils—and upon this fact his claim to distinction mainly rests. His subjects were mostly chosen from sacred and profane history, and from fable. He left a large quantity of work in Bologna—the picture of the Adoration of the Magi, in the church of S. Maria delle Grazie, being considered his masterpiece—not dissimilar in style to that of Paul Veronese.

FONTANEL' an artificial ulcer sometimes raised by a physician for the benefit of its derivative effect. Any hard mass kept under the skin for a time will produce the necessary irritation. The term F. is applied also to the soft pulsating spots on the head of a very young infant. Of these, there are three or four, the principal one being at the crossing of the main sutures. It generally closes within two years after birth, owing to the extension of the adjoining bones.

FONTANES, Louis, Marquis de, was b. 6th Mar., 1757, at Niort, and was sprung from an old Protestant family of Languedoc. After the completion of his studies, he went to Paris, where he acquired a reputation by his poems, *Le Cri de mon Cœur* (Paris, 1778), and *Le Verger* (Paris, 1778), as also by his metrical translation of Pope's *Essay on Man*, and his imitation of Gray's *Elegy written in a Country Churchyard*. During the revolution, F. conducted various journals in the popular interest. In 1802, he was made a member, and in 1804, president of the legislative body. His admiration of Napoleon was great; and his splendid oratorical talents were often employed in eulogizing the emperor's acts. Even when Napoleon was only consul, F. had irritated the republican party by speaking of the French people as *sujets* (subjects). In 1810, he entered the senate. After the fall of Napoleon, he passed into the service of the restored Bourbons, and was raised to the peerage by Louis XVIII. He died 17th Mar., 1821. His various writings, prose and poetic, have been collected and edited by Sainte-Beuve (2 vols., Paris, 1837), and are regarded as models of elegance and correctness.

FONTARABIA. See FUENTERRABIA.

FONTENAY-LE-COMTE, or FONTENAY-VENDÉE, a t. of France, in the department of Vendée, is situated in a pleasant valley on the right bank of the Vendée, 27 m. n.e. of La Rochelle. The streets of the older portion of the town are narrow and tortuous. Its chief buildings are the beautiful Gothic church of Notre Dame, with a spire 311 ft. high; the college, the theater, and the fountain from which the town is said to have derived its name. Fontenay-le-Comte has linen manufactures, tanneries, and a trade in timber, and is an entrepôt for the victuals and commodities of the south. Pop. in 1876, 7,309.

FONTENELLE, BERNARD LE BOVIER DE, an eminent French author, was b. at Rouen, 11th Feb., 1657. His father was an advocate, and his mother a sister of the great Corneille. He began his studies in the college of the Jesuits at Rouen, and at the age of 13, obtained the prize for a Latin poem. During the next three years he professed to study law, but in reality busied himself with the more interesting subjects of history, poetry, and philosophy. After passing as an advocate, he commenced to practice, but lost the first cause which he conducted, and in consequence renounced the bar forever. In 1674, he went to Paris, where he entered upon a literary career, and soon attained to celebrity and independence. He was a member of several learned societies; and from 1699 to 1741, held the office of secretary of the académie des sciences, but declined the post of president. F. died at Paris 9th Jan., 1757, having nearly finished his 100th year, wittily remarking to his friends, as he expired: "Je ne souffre pas, mes amis; mais je sens une certaine difficulté d'être" ("I don't suffer, my friends; but I feel a sort of difficulty in living any longer"). The greater part of his numerous poetical, historical, oratorical, philosophical, and scientific writings, though much admired at the time of their publication, have now fallen into oblivion. He possessed, however, along with great skill in representation, a poetical turn of mind, and an acute intellect. He wrote a few operas, among others, *Psyché*, *Bellérophon;* a musical and dramatic pastoral entitled *Endymion;* several tragedies—*Brutus*, *Aspar*, *Idalie;* comedies, fables, fugitive pieces, epigrams, etc. Of his prose writings, we may mention the *Lettres du Chevalier d'Her*, the *Dialogues des Morts*, in the manner of Lucian; his *Entretiens sur la Pluralité des Mondes*, which, although much read once, has now become obsolete, in consequence of the advancement of science; and his treatises *Sur l'Existence de Dieu; Sur le Bonheur; Sur l'Origine des Fables;* and his *Histoire du Théâter Français jusqu' à Pierre Corneille*, which is still consulted. F. was particularly celebrated for his *bon-mots;* and for the manner in which he edited the *Mémoires de l'Académie des Sciences*, and executed his *Eloges*. It is also perhaps worth mentioning, that at the age of 92 he still wrote madrigals! His *Œuvres Complètes* have been republished several times. The most complete edition is that published at Paris (3 vols., 1818).

FONTENOY, a village of Belgium, in the province of Hainaut, 5 m. s.w. of Tournay, with a pop. of about 800, deserves mention as the scene of the battle of Fontenoy, one of the most famous contests in the war of the Austrian succession. The battle was fought 11th May, 1745, the opposing forces being the French, 60,000 strong, under marshal Saxe, and the allies (English, Dutch, and Austrians), in nearly equal force, under the duke of Cumberland. After a hard-fought fight, the allies were forced to retreat. The loss on both sides was stated at about 7,000 men.

FONTEVRAULT, *Fons Ebraldi*, a small t. of France, in the department of Maine-et-Loire, 8 m. s.e. of Saumur, with a pop. of (1876) 2,651, owes its origin to a wealthy and celebrated abbey, now converted into a prison for eleven departments. This abbey was founded by Robert d'Arhrissel, a Breton monk, in 1099, as the residence of a monastic society composed of penitents of both sexes. This society took the name of the *order of Fontevrault*. It followed the austere rule of Benedict, but had this peculiarity, that the monks were ruled by an abbess, and not by an abbot. The order of F. soon spread through France, and into Spain, and in the former country especially acquired great riches. The abbesses of F. belonged, for the most part, to illustrious families, and were subject only to the popes. At a later period, the strictness of the monastic discipline was relaxed in favor of the nuns, whence, however, in the 14th c., sprung great disorders. Gradually, the order of F. fell into disrespect, but even at the outbreak of the French revolution it possessed 57 priories in France, which, however, were then abolished along with the other monasteries. The town is of peculiar interest to Englishmen, from the fact that it contains the cemetery of several of the Plantagenet kings of England and of the counts of Anjou. Of these, however, only the tombs of Henry II., of his queen Eleanor of Guienne, of Cœur-de-Lion, and of Isabelle, the queen of John, have been preserved. The old monastic buildings and court-yards, surrounded by walls, and covering from 40 to 50 acres, now form one of the larger prisons of France, in which about 2,000 men and boys are confined, and kept at industrial occupations. See an account of this prison in *Chambers's Edinburgh Journal*, 2d series, vol. i. p. 104.

FONTINA'LIS, a genus of mosses, allied to *hypnum*, but having the fruit in the bosom of the leaves, almost without stalk. Several species are British; one of which, the greater water-moss (*F. antipyretica*), growing upon rocks and roots of trees in brooks and ponds, is remarkable for the difficulty with which it burns, even when completely dried; on which account it is used in some parts of the n. of Europe for lining chimneys, to protect the adjacent wood-work from fire. Its shoots are a foot or more in length, and branched; they float in the water. The fruit is on the sides of the stems or branches.

FONVIELLE, WILFRID DE, b. Paris, 1828; was interested in mathematics, aeronautics, and journalism. Of late years he has made numerous balloon ascents, in order to carry on scientific experiments at great altitudes. During the siege of Paris he escaped from the city in a balloon, and proceeding to London, gave a series of lectures on the benefits of a republican form of government. His principal scientific works are *L'Homme Fossil; Les Merveilles du Monde Invisible; Eclairs et Tonnerres*, translated into English under the title of *Thunder and Lightning;* and *L'Astronomie Moderne*. An account of the balloon ascents made by M. Fonvielle, Mr. Glaisher, and others, appeared in French in 1870, and an English translation was published in 1871, under the title of *Travels in the Air*. In addition to the above-mentioned works, M. Fonvielle has written several political pamphlets.

FOO-CHOW. See FU-CHOW-FOO, *ante*.

FOOD AND DRINK. Although nearly sixty elementary substances are known to chemists, only a comparatively small number of these take part in the formation of man and other animals; and it is only this small number of constituents which are essential elements of our food. These elements are carbon, hydrogen, nitrogen, oxygen, phosphorus, sulphur, chlorine, sodium, potassium, calcium, magnesium, iron, and fluorine.

Carbon, hydrogen, nitrogen, and oxygen are supplied to the system by the albuminous group of alimentary principles (see DIET)—viz., albumen, fibrine, and caseine, which occur both in the animal and vegetable kingdoms, and the gluten contained in vegetables. Animal flesh, eggs, milk, corn, and many other vegetable products, contain one or more of these principles. The gelatinous group also introduces the same elements into the system, when such substances as preparations of isinglass, calves' feet, etc., are taken as food. Carbon, hydrogen, and oxygen are abundantly introduced into the system in the form of sugar, starch (which occurs in large quantity in the cereal grains, leguminous seeds, roots, tubers, etc., used as food), and organic acids (which, as citric, malic, tartaric acid, etc., occur in numerous vegetables employed as food). Carbon, with a little hydrogen and oxygen, occurs abundantly in the oleaginous group of alimentary principles, as, for instance, in all the fat, suet, butter, and oil that we eat; in the oily seeds, as nuts, walnuts, cocoa-nuts, etc.; and in fatty foods, as liver, brain, etc. Phosphorus is supplied to us by the flesh, blood, and bones used as food (the flesh of fishes is especially rich in phosphoric matter), and in the form of various phosphates,

it is a constituent of many of the vegetables used as food. The system derives its sulphur from the fibrine of flesh, the albumen of eggs, and the caseine of milk, from the vegetable fibrine of corn, etc., from the vegetable albumen of turnips, cauliflowers, asparagus, etc., and from the vegetable caseine of pease and beans. Most of the culinary vegetables contain it, especially the *cruciferæ*. Chlorine and sodium, in the form of chloride of sodium, are more or less abundantly contained in all varieties of animal food, and are taken separately as common salt. Potassium is a constituent of both animal and vegetable food; it occurs in considerable quantity in milk, and in the juice that permeates animal flesh; and most inland plants contain it. We derive the calcium of our system from flesh, bones, eggs, milk, etc. (all of which contain salts of lime); most vegetables also contain lime-salts; and another source of our calcium is common water, which usually contains both bicarbonate and sulphate of lime. Magnesium in small quantity is generally found in those foods that contain calcium. Iron is a constituent of the blood found in meat; and it occurs in smaller quantity in milk, in the yoke of egg, and in traces in most vegetable foods. Fluorine occurs in minute quantity in the bones and teeth. This small quantity is accounted for by the traces of fluorine found by Dr. George Wilson in milk, blood, etc.

These simple bodies are not, however, capable of being assimilated and converted into tissue; they must be previously combined, and this combination is primarily conducted by the vegetable kingdom. The number of combined elements varies: thus water contains only 2; sugar, starch, fat, and many organic acids, contain 3; caseine contains 5; and fibrine and albumen contain 6.

It would be impossible, and it is quite unnecessary, to mention in this article the different animals and plants that are used as food by different nations. The subject is, however, an interesting one, and those who wish to study it may be referred to Moleschott's *Physiologie der Nahrungsmittel*, 1850, and especially to Reich's *Nahrungs- und Genussmittelkunde* (1860–61), which is the most learned and elaborate work on the subject in any language.

DRINKS are merely liquid foods. They all pertain to the aqueous group noticed in the article DIET. They are arranged by Pereira in his *Treatise on Food and Diet* in the six following orders:

1. Mucilaginous, farinaceous, or saccharine drinks—as toast-water, barley-water, gruel, etc. They are very slightly nutritive, and differ but little from common water.
2. Aromatic or astringent drinks—as tea, coffee, chocolate, and cocoa. The action of the first two is noticed in the article DIET. The last two drinks contain a considerable quantity of oil and starch.
3. Acidulous drinks—as lemonade, ginger-beer, raspberry-vinegar water, etc. They allay thirst both by the acid which they contain and the water, and form cooling antiscorbutic drinks.
4. Drinks containing gelatine and osmazome—the broths and soups. These, if properly prepared, should contain all the soluble constituents of their ingredients.
5. Emulsive or milky drinks—as animal milk, the milk of the cocoa-nut, and almond milk, a drink prepared from sweet almonds. Animal milk contains all the essential ingredients of food; the others are slightly nutritive.
6. Alcoholic and other intoxicating drinks—including malt liquor or beer in its various forms of ale, stout, and porter; wines; spirits in their various forms of brandy, rum, gin, whisky, etc.

"Considered dietetically," says Pereira, "beer possesses a threefold property: it quenches thirst; it stimulates, cheers, and, if taken in sufficient quantity, intoxicates; and lastly, it nourishes or strengthens. The power of appeasing thirst depends on the aqueous ingredient which it contains, assisted somewhat by its acidulous constituents (carbonic and acetic acid); its stimulating, cheering, or intoxicating power is derived either wholly or principally from the alcohol which it contains (from 2 to 8 per cent); lastly, its nutritive or strengthening quality is derived from the sugar, dextrine, and similar substances contained in it; moreover, the bitter principle of hops confers on beer tonic properties. From these combined qualities, beer proves a refreshing and salubrious drink (if taken in moderation), and an agreeable and valuable stimulus and support to those who have to undergo much bodily fatigue.

Wine is our most valuable restorative when the powers of the body and mind have been overtaxed; but as the most perfect health is compatible with total abstinence from it, no possible benefit can accrue to a healthy person from commencing its use. The uses of wine as a tonic during convalescence after lingering diseases, and of either wine or spirits in some acute diseases (fevers, etc.), are too well known to require notice.

The action of spirituous drinks has been noticed in the article DIET, and will be further discussed in the article TEMPERANCE.

We shall conclude this part of the subject with a word or two on the condiments or seasoning agents which are taken with foods for the purpose of improving their flavor. Excluding salt, which must be considered as a saline alimentary principle, the most common condiments, such as mustard, capsicum (Cayenne pepper), pepper, the various spices, etc., owe their action to the presence of a volatile oil. Sauces are usually fluid mixtures of these condiments with alimentary substances. In a healthy state, condiments and sauces afford little or no nutrition; and although for a time they may stimu-

late a debilitated stomach to increased action, their continual use never fails to induce a subsequent increased weakness of that organ. Salt and vinegar are the only exceptions. When used in moderation, they assist in digestion; vinegar, by rendering muscular fiber more fluid; and both together, by producing, as Dr. Beaumont believes, a fluid having some analogy to the gastric juice (*Experiments and Observations on the Gastric Juice and the Physiology of Digestion*, p. 40, Edin. 1838).

The cookery of foods, although partially noticed in the articles BOILING, BROILING, COOKERY, DIET, etc., requires some general consideration in the present place.

All foods possessing an organized structure, as animal flesh and amylaceous substances, require to be cooked before being eaten, the only exceptions being the oyster and some ripe fruits. The processes of salting, pickling, and smoking harden the animal textures, and, as we shall presently see (at all events in the case of salting), induce chemical changes which render the meat less nutritious.

The ordinary operations of cookery are boiling, roasting, broiling, baking, and frying.

In the case of vegetables, boiling affects the solution of gummy and saccharine matters, the rupture and partial solution of starch grains, the coagulation of albuminous liquids, and the more or less complete expulsion of volatile oil. In the boiling of flesh, there takes place a more or less perfect separation of the soluble from the insoluble constituents, according to the duration of the boiling, the amount of water employed, and its temperature at the commencement of the operation. If we wish the boiled meat to contain the largest amount of nourishing matter, and disregard the soup or broth that is simultaneously formed, we introduce it into the boiler when the water is in a state of brisk ebullition. We keep up this boiling for a few minutes, in order to coagulate the albumen near the surface, and thus to convert it into a crust or shell, which equally prevents the entrance of water into the interior, and the escape of the juice and soluble constituents of the flesh into the water. If cold water is then added, so as to reduce the temperature to about 160°, and this temperature is kept up for the necessary time—for which, in reference to the weight of the meat, see the article BOILING—all the conditions are, according to Liebig, united which give to the flesh the quality best adapted to its use as food.

If, on the other hand, we wish to obtain good soup from meat, we should place it in cold water, and bring this *very gradually* to the boiling-point. The interchange between the juices of the flesh and the external water, which was prevented by the former process, here takes place without hindrance. "The soluble and sapid constituents of the flesh are dissolved in the water, and the water penetrates into the interior of the mass, which it extracts more or less completely. The flesh loses, while the soup gains, in sapid matters; and by the separation of albumen, which is commonly removed by skimming, as it rises to the surface of the water, when coagulated, the meat loses its tenderness, and becomes tough and hard; and if eaten without the soup, it not only loses much of its nutritive properties, but also of its digestibility."—Liebig's *Researches on the Chemistry of Food*, p. 128.

Roasting is applied much more to meat than to vegetables. Both in roasting and broiling meat, the first application of heat should be considerable and rapid, so as to form an outer coating of coagulated albumen (just as in boiling), which retains the nutritive matters within the cooked meat. In roasted meat, nothing is removed but some of the superficial fat and the gravy, which is itself an article of food. The effect of roasting on such vegetables as apples and potatoes is to render them more nutritive and digestible than they would be in the raw state, by splitting their starch grains, and rendering them more soluble.

Baking (q.v.) acts in the same manner as roasting, but meat thus cooked is less wholesome, in consequence of its being more impregnated with empyreumatic oil.

Frying is the most objectionable of all kinds of cookery. In this operation, heat is usually applied by the intermedium of boiling fat or oil. Various products of the decomposition of the fat are set free, which are very obnoxious to the stomachs of invalids.

Liebig has shown that salted meat is, in so far as nutrition is concerned, in much the same state as meat from which good soup has been made. After flesh has been rubbed and sprinkled with dry salt, a brine is formed amounting in bulk to one third of the fluid contained in the raw flesh. This brine is found to contain a large quantity of albumen, soluble phosphates, lactic acid, potash, creatine, and creatinine—substances which are essential to the constitution of the flesh, which therefore loses in nutritive value in proportion to their abstraction.

The preservation of food requires some notice. Three methods—viz., preservation by cold, preservation by the exclusion of air, and preservation by salting—are noticed in the article ANTISEPTICS. The first is only of comparatively limited application: the second, known as Appert's method, has been successfully used in the English navy for many years; the chief objection to it is its expense: the third method injures, as we have already seen, the character of the meat, and renders it both deficient in nutritive materials, and actually injurious if it forms a principal and continuous article of diet. To these methods we must add preservation by smoking, preservation with sugar, and with vinegar, and preservation by drying. It is well known that meat suspended in

smoke loses its tendency to putrefy, the substance from which the smoke derives its antiseptic property being creasote, or some allied body. Smoked meat acquires a peculiar taste, a dark color, and a somewhat hard consistence: but it retains all its nutritive constituents, and is thus preferable to salted meat. Sugar and vinegar are chiefly employed in the preservation of vegetable products. The most important mode of preserving articles of food, whether animal or vegetable, is by direct drying. Meat is cut up into small slices about a quarter of an inch thick, and vegetables into smaller pieces; they are steamed at a high temperature, so as to coagulate the albumen; and they are then completely desiccated by exposure to a current of very hot dry air. At the conclusion of the process, the slices of meat are quite hard, and present a shriveled appearance. Dr. Marcet (*On the Composition of Food*, 1856, p. 174) speaks in high terms of this method, which he had himself seen in operation in Paris. "Food thus preserved," he says, "whether it be animal or vegetable, has the advantage (1) of remaining in a iresh condition, though freely exposed to the atmosphere for a great number of years, and (2) of being reduced to one fifth of its original bulk from its having lost all its water." He adds, that the preserved vegetables resume their bulk when boiled in water, and that they so completely retain their aroma, that it is often difficult to distinguish between soups made with them, and others prepared with fresh vegetables.

The adulteration of food of almost every kind is unfortunately so common a custom, that our limited space will merely allow of our noticing a few of the leading points in regard to it.

Wheat-flour is not unfrequently adulterated with one or more of the following substances: flour of beans, Indian corn, rye, or rice, potato-starch, alum, chalk, carbonate of magnesia, bone-dust, plaster of Paris, sand, clay, etc. The organic matters—the inferior flours and starch—do little or no serious harm; most of the inorganic matters are positively injurious, and of these, alum (one of the commonest adulterations) is the worst. The beneficial action of wheat-flour on the system is in part due to the large quantity of soluble phosphates which it contains. When alum is added, these phosphates are decomposed in the process of making bread, the phosphoric acid of the phosphates uniting with the alumina of the alum, and forming an insoluble compound; the beneficial effect of the soluble phosphates is thus lost.

Arrow-root is adulterated with potato-flour, sago, starch, etc. Out of 50 samples examined by Dr. Hassall, 22 were adulterated, and in 10 of the samples there was scarcely a particle of the genuine article.

Sugar of the inferior kinds is occasionally adulterated with flour, gum, starch-sugar, etc. It is oftener, however, impure than intentionally adulterated.

Pepper is adulterated with linseed, mustard-seed, wheat-flour, etc.

Cayenne pepper is adulterated with red led, vermilion, red ocher, brick-dust, common salt, turmeric, etc.

Mustard is largely adulterated with ordinary and pea flour, linseed meal, and turmeric; and a little chromate of lead is sometimes added to improve the color. Dr. Hassall submitted 42 specimens of mustard to examination; the whole of them contained wheat-flour and turmeric.

Ginger is frequently adulterated. Out of 21 samples, Dr. Hassall found that 15 contained various kinds of flour, ground rice, Cayenne pepper, mustard husks, and turmeric, which in most cases formed most of the so-called ginger.

Out of 26 samples of *mixed spices*, 16 were found by Dr. Hassall to contain sago-meal, ground rice, wheat-flour, etc.

Curry powder (q.v.) was found by Dr. Hassall to be very commonly adulterated, only 7 specimens out of 26 being genuine. In 8 of the samples, red lead was detected. The frequent use of curries may thus often give rise to the disease known as lead-palsy.

The adulterations of *tea*, both by the Chinese and in this country, are too numerous for us to mention. See Hassall's *Adulterations Detected*, pp. 65–104.

Coffee, in its powdered form, is not merely largely adulterated with chicory, but additionally with roasted grain, roots, acorns, sawdust, exhausted tan (termed croats), coffina (the seeds of a Turkish plant), burnt sugar, and (worst of all) baked horses' and bullocks' liver. In the *Quarterly Journal of the Chemical Society* for April, 1856, there is an excellent report by Messrs. Graham, Stenhouse, and Campbell on the mode of detecting vegetable substances mixed with coffee. Even whole roasted coffee is not safe from adulteration, a patent having been actually taken out to mold chicory into the form of coffee-berries.

Cocoa and chocolate are adulterated with flour, potato-starch, sugar, clarified mutton-suet, and various mineral substances, such as chalk, plaster of Paris, red earth, red ocher, and Venetial earth, the last three being used as coloring matters.

The adulterations of *beer*, *wine*, and *spirits* are noticed in the articles devoted to those subjects.

Vinegar is adulterated with water, sulphuric acid, burnt sugar, and sometimes with chillies, grains of paradise, and pyroligneous acid. The English law allows one part of sulphuric acid to 1000 of vinegar, with the view of preserving it from decomposition, but Dr. Hassall found that in many cases three or four times the legal amount was present. It appears from evidence taken before the parliamentary committee on adulterations, that arsenic and corrosive sublimate are no uncommon ingredients in vinegar. In con-

nection with vinegar we may place *pickles*. Dr. Hassall analyzed 16 different pickles for copper, and discovered that poisonous metal more or less abundantly in *all* of them; "in three, in a very considerable quantity; in one, in highly deleterious amount; and in two, in poisonous amount." Preserved fruits and vegetables (especially gooseberries, rhubarb, greengages, and olives) are often also contaminated largely with copper. In these cases, the copper, if in considerable quantity, may be easily detected by placing a piece of polished iron or steel in the suspected liquid for 24 hours, to which we previously add a few drops of nitric acid. The copper will be deposited on the iron. Or ammonia may be added to the fluid in which the pickles or fruit were lying, when, if copper is present, a blue tint is developed. We should be suspicious of all pickles, olives, preserved gooseberries, etc., with a particularly bright green tint.

Milk is usually believed to be liable to numerous adulterations, such as flour, chalk, mashed brains, etc. It appears, however, from Dr. Hassall's researches on London milk, that, as a general rule, water is the only adulteration. The results of the examinations of 26 samples were, that 12 were genuine, and that 14 were adulterated, the adulteration consisting principally in the addition of water, the percentages of which varied from 10 to 50 per cent, or one half water. In the article MILK we shall describe the means of testing the purity of this fluid.

If space permitted, we might extend the list of alimentary substances liable to adulteration to a much greater length. In conclusion, we may remark, that, as a general rule, adulterations of an organic nature, such as flours and starches of various kinds, are best detected by the microscope; while chemical analysis is usually necessary for the detection of mineral adulterations. Dr. Hassall's *Adulterations Detected* is a perfect cyclopædia on this subject. See FOOD.

FOOD. The food of man is derived entirely from the vegetable and animal kingdoms.

Of animals used for F. by man the catalogue is very large. Savages, impelled by hunger, and unrestrained by any of those opposing considerations which are always powerful with civilized man, eagerly devour almost every animal on which they can lay their hands, vertebrate or invertebrate, and whether in a fresh state or far gone in putrefaction.

There is no vertebrate animal of which the flesh is known to be poisonous or positively unwholesome, except some species of fish, chiefly found in tropical seas. Of vertebrate animals, every class—mammals, birds, reptiles, and fishes—affords common and much esteemed articles of food. Of mammals, those principally used for this purpose are the herbivorous quadrupeds, and most of all the ruminants, of some of which the milk also is much employed. The flesh of some of the pachyderms is also used, particularly that of the hog; and that of some of the rodents, as the hare, rabbit, capybara, etc.—although the idea of eating others of the rodents, as mice and rats, would be rejected with disgust by all except savages. The flesh of monkeys is eaten in some parts of the world, although a strong aversion to it is more generally entertained, at least by civilized nations, probably on the ground of the animal's resemblance to the human form; for travelers who have been compelled to eat monkey-flesh, declare it to be very good. The flesh of whales and other ordinary cetacea is scarcely used except by rude tribes; although that of porpoises was formerly in great request in England, especially during Lent, the porpoise passing for a fish. The flesh of the herbivorous cetacea, as the manati and dugong of tropical seas, is esteemed. The flesh of some of the herbivorous marsupial quadrupeds, as the kangaroo, is eaten; but that of the carnivorous marsupials and of carnivorous quadrupeds generally is rejected.—The same general remark applies to birds: the flesh of birds of prey is rank, coarse, and unfit for human F.; but that of almost all birds which feed on leaves, seeds, and other vegetable substances, or on insects, worms, mollusks, etc., is good for eating. Web-footed birds, particularly the *anatidæ*, and gallinaceous birds (including pigeons), are more extensively used than any others; but birds of other orders are also eaten; and some of the small *insessores*, as ortolans, bec-fins, larks, etc., are brought to market as delicacies.—Of reptiles, one order—that of ophidian reptiles, or serpents—affords F. only to savages; but some of the chelonian reptiles—turtles—are in high esteem; the batrachian order contains the frogs, which find a place on the most luxurious tables in some countries of Europe; and to the saurian order, or lizard-like reptiles, belong species—as the iguanas of South America, creatures of sufficiently uncouth appearance—which, however disgusting to British readers in general may be the thought of eating them, many of their countrymen have learned to esteem as a delicacy. The eggs of turtles and iguanas are also used for F., as well as those of many kinds of birds. Of mammals, birds, and reptiles, the parts chiefly used for F. are the muscles or flesh, and the fat; but other parts of some animals are also used, as the kidneys, the lungs, the livers, the stomachs of ruminants (*tripe*), the gizzards of birds, etc.—Very many kinds of fishes are excellent for F., both of cartilaginous and bony fishes; and they belong to many different families.

Of invertebrate animals, some of the mollusks are very generally used. It is unnecessary to do more than name oysters, mussels, and the snails of Italy as examples. Comparatively few mollusks, however, form articles of human food. The same remark applies to crustaceans, although crabs, lobsters, cray-fish, prawns, and shrimps are well-

known exceptions. It may almost be said that no articulated animals of any other class are used for F. except by savages; the occasional use of locusts and of the larvæ of some coleopterous insects (gru-gru worms, etc.), scarcely requiring a qualification of the statement. And of the radiated animals, the same general statement may be made; the *bêche-de-mer* or *trepang*—of which, however, the use is almost confined to the Chinese—being the only considerable exception.

Honey, although collected and modified by insects, is rather a product of the vegetable than of the animal kingdom. The same remark applies to a very different substance, the sea-weed gelatine of which certain swallows of the East Indies make their edible nests.

All the great divisions of the vegetable kingdom yield F. for man—the phanerogamous, however, much more largely than cryptogamous plants. Of the latter, the mosses and *hepaticæ* contain no species that is used for this purpose; the same may almost be said of lichens, notwithstanding the tripe-de-roche and Iceland moss; but numerous species of *algæ* and of *fungi* are edible; and a few ferns supply unimportant articles of food. Of phanerogamous plants, it is perhaps impossible to say whether the endogenous or the exogenous are most important in this respect, notwithstanding the place of the cereal grasses among the former. The plants yielding F. are also distributed among many natural orders, although some, as *gramineæ*, *leguminosæ*, and *cruciferæ*, contain a large number of the most useful species. The parts of plants which yield F. are very various: the roots and tubers, bulbs, etc., of some; the stems of others; leaves; flowers; the fleshy part of fruits; the seed, etc. The part which man appropriates to himself is either used uncooked, or requires to be cooked in order to fit it for use. Sometimes, also, other previous preparations are necessary, as the grinding of corn, etc. Except in the case of ferns, when the cryptogamous or acotyledonous plants are used for food, the whole plant is used, e.g., mushrooms, carrageen, Iceland moss. Sometimes no part of the plant is itself fit for use, but it contains some substance which is, and which man extracts by suitable processes, as in the case of arrow-root, sago, and other kinds of starch, sugar, etc.

The first place among articles of vegetable F. must be assigned to *corn*, the seeds of the *cerealia* (q.v.). The next place, perhaps, belongs to the potato and yam, after which come the banana, cassava or mandioc, and the different kinds of pulse.

Regarded more botanically, the articles of F. are—

1. Roots, properly so called, of which the turnip, carrot, parsnip, beet and mangold, cocco or eddoes, may be mentioned as among the most important; but the number of esculent roots, and of roots yielding articles of F., is very great.

2. Tubers, of which the potato, yam, and batatas or sweet-potato, are the most important; with the cassava or mandioc and the arrow-root as yielding starch; but of which many others are also used, as the melloco (*ullacus*), the oca (*oxalis*), the earth-nut, etc.

3. Rhizomes, or root-stocks, of which some are simply boiled, whilst others are chiefly valued for the starch (arrow-root, etc.) which they yield.

4. Bulbs, as those of the onion, garlic, shallot, etc. The most important are alliaceous.

5. Stems, which, in some cases, are eaten along with the leaves, whether as salads or boiled vegetables; but of which some are more important as yielding sago and other kinds of starch. The eatable part of asparagus is a stem in the beginning of its growth, and the same statement applies to some other plants; the eatable part of kohl-rabi is a peculiar swelling of the stem.

6. Leaves and leaf-buds, as those of kale and cabbage, with other *greens* of all sorts, spinach, lettuce, and all the other salads; the terminal buds of palms (palm-cabbage), etc.

7. Flowers and adjoining parts, as in cauliflower and artichoke.

8. Fruit (exclusive of seeds), used either as a principal article of F., as in the case of the banana, and, to some extent, of gourds, or more generally as an article of luxury. See Fruit.

9. Seeds, of which the most important are those of the cereal grasses (see Cerealia), along with which must be mentioned those of buckwheat, quinoa, the lotus of the Nile and other water-lilies, the nelumbo, the water-chestnut and other species of *trapa*, many kinds of *pulse*, as peas, beans, lentils, kidney-beans, chick-peas, etc., and nuts of many kinds, some of which, as the chestnut and cocoa-nut, afford, in some countries, substantive and important articles of F., whilst the greater number are rather articles of occasional use and of luxury. There are also other seeds which are capable of being used, and are occasionally used as food.

Sugar, which may well be reckoned among important articles of F., is obtained from the juice of stems; as of the sugar-cane, some palms, and the sugar-maple, and of roots, as of the beet, etc. Alcoholic beverages are obtained from vegetable substances and juices which contain sugar, or which, by some artificial process, are, in the first instance, converted into sugar; as the juices of fruits (the grape, apple, etc.), the juices of stems (the sugar-cane, palms, etc.), the juices of roots and tubers (beet-root, potatoes, etc.), and the seeds of the cereal plants (barley, rice, etc.).

Besides the substantive articles of F., and beverages more or less generally used,

there are very many condiments, which are obtained from the vegetable kingdom, and of which the botanical sources are almost equally various, as mustard, pepper, ginger, cloves, capers, etc.

FOOL. See COURT-FOOL.

FOOLAHS, or FELLATAH. See FULAHS, *ante*.

FOOLS, FEAST OF. The Romans kept the festival of Saturn, in Dec., as a time of general license and revelry. During the brief season of the saturnalia (q.v.), the slave reclined on his master's seat at table, the master waited upon his slave, and society, for the moment, seemed to be turned upside down. The grotesque masquerade survived the pagan creed which gave it birth, and not only kept its place among the Christians, but, in the face of solemn anathemas of fathers and councils, found its way into the ceremonial of the Christian church. It was called, at different times and places, by many different names, but has latterly come to be best known as the feast of fools (*festum fatuorum, festum stultorum*).

The circumstances of the observance were almost infinitely varied, but it was everywhere marked by the same spirit of broad, boisterous drollery, and coarse but not ill-natured caricature. The donkey played such a frequent part in the pageant that it was often called the feast of asses (*festum asinorum*). In some places, the ass of Balaam was figured; in others, the ass which stood beside the manger in which the infant Savior was laid; elsewhere, the ass on which the Virgin and Child fled to Egypt, or the ass on which Jesus rode into Jerusalem. In every instance, there was more or less attempt at dramatic representation, the theater being generally the chief church of the place, and the words and action of the drama being often ordered by its book of ceremonies. Several rituals of this sort are still preserved. That which was in use at Beauvais, in France, has a rubric ordering the priest when he dismisses the congregation to bray three times, and ordering the people to bray three times in answer. As the ass was led towards the altar, he was greeted with a hymn of nine stanzas, of which the first runs thus:

Orientis partibus,
Advenavit Asinus,
Pulcher et fortissimus,
Sarcinis aptissimus.
Hé, Sire Ane, hé!

[From the regions of the East—
Blessings on the bonny beast!—
Came the donkey, stout and strong,
With our packs to pace along.
Bray, Sir Donkey, Bray!]

Where the ass did not come upon the stage, the chief point of the farce lay in the election of a mock pope, patriarch, cardinal, archbishop, bishop, or abbot. These mimic dignitaries took such titles as "Pope of Fools," "Archbishop of Dolts," "Cardinal of Numskulls," "Boy Bishop," "Patriarch of Sots," "Abbot of Unreason," and the like. On the day of their election, they often took possession of the churches, and even occasionally travestied the performance of the church's highest office, the mass, in the church's holiest place, the altar. In some convents, the nuns disguised themselves in men's clothes, chanted mock services, and elected a "little abbess," who for that day took the place of the real abbess.

The feast of fools maintained itself in many places till the reformation in the 16th century. At Antibes, in the s. of France, it survived till the year 1644, when we have it described by an eye-witness in a letter to the philosopher Gassendi. The scene was, as usual, a church; and the actors, dressing themselves in priests' robes turned inside out, read prayers from books turned upside down, through spectacles of orange-peel; using coal or flour for incense, amid a babblement of confused cries, and the mimic bellowings of cattle, and grunting of pigs.

The history of the feast of fools has been treated in several works; the best is the *Mémoire pour servir à l'Histoire de la Fête des Fous*, by Du Tilliot, published at Lausanne in 1741; reprinted at Paris in 1751, and again in the *Recueil des Cérémonies et Coutumes Religieuses de Tous les Peuples*, tome viii. (edit. Prudhomme 1809.)

FOOL'S PARSLEY, *Æthusa cynapium*, an umbelliferous plant, very common as a weed in gardens and fields in Britain, and in most parts of Europe, somewhat resembling parsley in its foliage and general appearance, so that serious accidents have occurred from its being mistaken for that herb; it being a poisonous plant, somewhat resembling hemlock in its properties. With the curled variety of parsley it cannot easily be confounded, which is even on other accounts to be preferred; and when in flower it is readily known from every other plant in British gardens by its umbels wanting general involucres, and having partial involucres of three slender leaves hanging down on one side.

FOOT is the most common unit of lineal measure all over the world. It has been evidently taken originally from the length of the human foot, and as that varies in length, so does the measure; each country, and at one time each town, having a F. of its own. The three foot-measures that occur most frequently are the Paris F., or *pied de*

roi, the (German) Rhenish F., and the English. Compared with the French *meter* (= 3.28090 ft. Eng.), they stand thus:

	Meters.		In. English.
English foot	= 0.30479	Paris foot	= 12.78912
Paris "	= 0.32484	Rhenish foot	= 12.35652
Rhenish "	= 0.31385		

In round numbers, 46 French ft. = 49 English ft., 34 Rhen. or Germ. ft. = 35 English, and 57 French ft. = 59 Rhenish. The Russian F. is equal to the English. Almost every German state has or had a different foot. The Rhenish F. is that used in Prussia. The longest F. occurring is the old Turin F. = 20 in. English. Many local feet are only about 10 inches. The F. has almost uniformly been divided into 12 in.; the inch into 12 lines, often into tenths. The French *pied usuel* is the third part of the meter. See YARD, METER.

FOOT, in music, is a term made use of in the same way as in poetry, denoting a short melodic figure of notes with only one accent. F. is also now beginning to be used in speaking of the pitch of sounds. The Germans have always used the word *fusston* in representing the pitch of the different stops of an organ, such as *Principal* 16 F., 8 F., or 4 F., etc., which practice is now being introduced into English organs, and is found very useful to organists. The pitch of the stop is fixed according to the length of the lowest C. pipe. See ORGAN.

FOOT, in verse. See METER, VERSE.

FOOT, STRUCTURE OF THE. In describing the structure of the F., it is expedient to commence with a brief notice of the bones which occur in it. In man, these are 26 in number; and are arranged in three natural groups—viz., the tarsal bones, which are the hindermost; the metatarsal bones, which occupy the middle portion; and the phalanges of the toes anteriorly. The tarsal bones, 7 in number, are short and thick, and form the heel and the hinder part of the instep. The uppermost is called the *astragalus*, from its supposed resemblance to the dice used by the Romans. Above, it is articulated or is jointed with the two bones of the leg, the *tibia* and *fibula*, and through these bones the whole weight of the body is thrown upon the two *astragali*. Behind, it is connected with and rests upon the *os calcis*, or heel-bone, which is the largest bone of the foot. Immediately in front of it, and supporting it in this direction, is the *scaphoid* or boat-like bone. In front of the scaphoid bone are the 3 *cuneiform* or wedge bones; and on the outer side of the cuneiform bones, and in front of the os calcis, is the *cuboid* bone. The front row of tarsal bones is composed of the 3 cuneiform bones on the inner side of the F., and of the cuboid bone externally. There are 5 metatarsal bones passing forward, one for each toe. Each cuneiform bone is connected with one, and the cuboid bone with two, of these metatarsal bones. Behind, they are close together, but as they run forwards, they diverge slightly from one another, and their anterior ends rest upon the ground, and form the *balls* of the toes. They constitute the forepart of the instep. The remaining bones are those of the toes, and are named the *phalanges*, each toe having three of these bones, excepting the great toe, which has only two. (A similar law holds for the bones of the hand, each finger having three phalanges, but the thumb only two.)

The instep is composed of the 7 tarsal and the 5 metatarsal bones, which are so arranged and connected as to form an arch from the extremity of the heel-bone to the balls of the toes. This is called the plantar arch, from *planta*, the sole of the foot. The astragalus forms the summit or keystone of this arch, and transmits the weight which it receives posteriorly to the heel, and anteriorly to the balls of the toes. The arrangement of the fibers and laminæ in the interior of the bones, is such that the greater number of them, in each bone, follow the directions of the two pillars of the arch, and thus give the greatest strength to the bones in the directions in which it is most required.

The bones, where they articulate with one another, are covered with a tolerably thick layer of highly elastic cartilage, and by this means, together with the very slight movements of which each bone is capable, a degree of elasticity is given to the F., and consequently to the step, which would be altogether wanting if the plantar arch were composed of one single mass of bone. This elasticity is far greater in the anterior pillar of the arch, which is composed of five comparatively long bones sloping gradually to the ground, than in the posterior pillar, which is short, narrow, and composed of a single bone, which descends almost vertically from the ankle to the ground. Hence, in jumping from a height, we always endeavor to alight upon the balls of the toes, and thus break the shock which we should feel if, by accident, we descended upon the heels.

A reference to any standard work on anatomy (see, for example, Gray's *Anatomy*, pp. 178–84) will show that the ligaments which unite these bones to one another, and by which the movements of each bone upon the others are limited, are very numerous. We shall merely notice two of these ligaments, selecting those whose action is especially obvious in maintaining the shape of the plantar arch. One, the *plantar ligament*, of great strength, passes from the under surface of the heel-bone, near its extremity,

forwards to the ends of the metatarsal bones, according to Dr. Humphry (*The Human Foot and the Human Hand*, 1861, p. 25). Most anatomists do not trace it quite so far forwards. "In other words" (we quote from Dr. Humphry's volume), "it extends between the lowest points of the two pillars of the arch, girding or holding them in their places, and preventing their being thrust asunder when pressure is made upon the key-bone, just as the 'tie-beam' of a roof resists the tendency to outward yielding of the sides when weight is laid upon the summit. The ligament, however, has an advantage which no tie-beam can ever possess, inasmuch as a quantity of muscular fibers are attached along the hinder part of its upper surface. These instantly respond to any demand that is made upon them, being thrown into contraction directly the F. touches the ground; and the force of their contraction is proportionate to the degree of pressure which is made upon the foot. In addition to its office of binding the bones in their places, the ligament serves the further purpose of protecting from pressure the tender structures—the blood-vessels, nerves, and muscles—that lie above it in the hollow of the foot. Another very strong ligament passes from the under and fore part of the heel-bone to the under parts of the scaphoid bone. It underlies and supports the round head of the astragalus, and has to bear a great deal of the weight which is transmitted to that bone from the leg. It possesses a quality which the ligament just described, and most ligaments have not—viz., elasticity. This is very important, for it allows the head of the keybone to descend a little, when pressure is made upon it, and forces it up again when the pressure is removed, and so gives very material assistance to the other provisions for preventing jars, and for giving ease and elasticity to the step."—Humphry, *op. cit.*, pp. 25, 26.

The spot over which this ligament extends is the weakest in the F., the astragalus being there unsupported by any bones; additional support is, however, afforded when it is most required by the tendon of a strong muscle, the *posterior tibial*, which passes from the back of the tibia (the chief bone of the leg) round the inner ankle, to be inserted into the lower part of the inner surface of the scaphoid bone. It not unfrequently happens that the astragalus, being either insufficiently supported, or from its being overweighted, descends slightly below its proper level, causing a lowering of the arch, and a flattening of the sole of the foot. The defect, when slight, is known as "weak-ankle;" when more decided, it is termed "flat-foot;" and in extreme cases the bone may descend to such an extent as even to render the inner side of the F. convex, when it naturally should be concave.

The deformity of which we are speaking is of such great practical importance, that we shall add a few words about its most common causes.

There are two periods of life at which *flat-foot* is especially liable to occur: 1st, in infancy, if the child be put upon its feet before the bones and ligaments—especially the latter—are strong enough to bear its weight; and 2dly, about the age of 14—a period at which growth is very quick, and the body consequently attains a considerable and rapid augmentation of weight. If young persons of this age are obliged to be a great deal on their feet, and perhaps additionally to carry weights (as, for example, butchers' and bakers' boys, and young nursemaids), the chances that flat-foot will occur are increased.

We now come to the movements of the foot upon the leg. We see here a striking combination of variety of movement with general security. This combination is effected by the harmonious action of three joints, each of which acts in a direction different from the others.

The first of these joints is the ankle-joint, which is formed by the bones of the leg —the tibia and fibula—above and the astragalus below. By this joint, the foot is bent or straightened on the leg. The second joint is between the astragalus and the heel-bone, and it permits the foot to be rolled inwards or outwards; while the third joint is between the first and second row of tarsal bones—namely, between the astragalus and heel-bone behind, and the scaphoid and cuboid bones in front, and allows the degree of curvature of the plantar arch to be increased or diminished within certain limits. The following is the order in which the movements of these three joints occur: the raising of the *heel* (by the first joint), is accompanied by a rolling of the F. *in*wards (by the second joint), and by an increased *flexure* of the plantar arch (by the third joint); and the raising of the *toes* is accompanied by a rolling of the foot *out*wards and a *straightening* of the sole. See Humphry, *op. cit.*, p. 42.

The joints, however, merely allow of movements; they do not effect them; this is the special function of the muscles; and each of the three movements we have indicated is effected by special groups of muscles. The first series of movements is mainly effected by three muscles, viz.: (1) the *muscles of the calf*, attached above to the bones of the thigh and leg, and below by the *tendo Achillis* to the heel-bone; (2) the *posterior tibial*, attached above to the tibia, and below by its tendon to the scaphoid bone; and (3) the *short fibular*, attached above to the fibula, and below by its tendon to the outer metatarsal bone. The calf-muscles, whose tendon is inserted into the heel-bone, are large and very powerful, for in raising the heel, they have to raise the weight of the body. The other two muscles, the posterior tibial and the short fibular, turn round the inner and outer ankle respectively, and are inserted into the inner and the outer edges of the instep; the former being attached to the scaphoid, and the latter to the outer metatarsal

bone. They not only assist to raise the ankle, but support it laterally. The muscle whose tendon is on the inner side of the F. (the posterior tibial), effects the two movements which are associated with the raising of the heel-bone, namely, the turning of the F. inwards, and the increased flexure of the arch.

The second series of movements—the raising of the toes, the turning of the F. outwards, and the straightening of the sole—are effected by two muscles, the *anterior tibial* and the *third fibular*, whose tendons pass, one in front of the inner ankle, and the other in front of the outer ankle, to the corresponding edges of the instep, and are inserted into the internal cuneiform and the outer metatarsal bones. These muscles are direct flexors of the tarsus upon the leg; the former raising the inner, and the latter the outer border of the foot.

Another point in the anatomy of the F. that requires notice, is the mode of union of the metatarsal with the tarsal bones. In these joints in the fourth and fifth toes a slight revolving motion can take place, which probably enables the outer metatarsals to adapt themselves to inequalities of the ground, and to equalize the distribution of the weight which is thrown upon the F.; while, in the corresponding joints of the three inner toes, scarcely any motion can occur—a provision by which additional strength is given to the inner side of the F. upon which the weight of the body most directly falls.

The skin of the sole is very tough and strong; and intervening between it and the bones and long plandalar ligament is a thick pad of fat, which acts the part of an air or water cushion in defending the adjacent parts from injurious pressure, and in deadening the jars and shocks that would otherwise be felt in leaping, etc.

A few remarks on the subject of shoes may here be added. In the foot in its normal state, the great toe is free from the others, and the line of its axis prolonged backwards, passes through the center of the heel; while in a foot distorted by the use of a shoe, the line of the great toe is quite altered, and the toes generally—not being able to find room side by side—overlap each other, and lose their separate and individual actions; corns, bunions, and ingrowing toe-nails being the natural consequence of this maltreatment. Prof. Meyer, of Zurich, has drawn attention to the bad treatment which the foot receives from ordinary shoemakers, in a pamphlet, translated by Mr. Craig, and entitled *Why the Shoe Pinches: a Contribution to Applied Anatomy*. He especially points out that the great toe should be allowed to have its normal position, and this can be done by making the inner edge of the sole incline *in*wards, instead of *out*wards, from the balls of the toes. Dr. Humphry, from whose admirable work we have drawn much of this article, while fully according in Meyer's views, additionally protests against high heel-pieces, as tending to make the step less steady and secure, to shorten it, and to impair the action of the calf-muscles; a high heel-piece, moreover, places the forepart of the foot at a lower level than the heel; the weight is thus thrown too much in the direction of the toes, and they are thrust forwards and cramped against the upper leather of the shoe.

The subjects of WALKING, RUNNING, and JUMPING are noticed in the article GYMNASTICS.

If we compare the human F. with the feet of other mammals, we find that it presents certain peculiarities, all of which have reference to man's erect posture. The chief peculiarities are—1. The greater relative size of the tarsal bones, as compared with the other bones of the F., and the more perfect formation of the plantar arch, which is higher and stronger than in any of the lower animals. Strength and elasticity are thus combined in the human F. in the highest degree. 2. The great toe is remarkable in man for its size and strength, and for the firm manner in which its metatarsal bone is joined to the other bones, so as to render it the main support to the foot. 3. If we compare the human F. with that of the gorilla, or any other anthropomorphous ape, we see that the toes are short and small in man in relation to the other parts of the F., while in the gorilla the toes form the greater part of the foot. Indeed, in this animal (and the same is the case in all the *genera* of apes and monkeys) the organ in question is rather a *hand* than a *foot*, and hence the term *quadrumanous*, as applied to this class of animals. There is scarcely any plantar arch, and the weight of the body bears chiefly on the outer edge of the F.; the digits are long and strong, and the inner one diverges so as to form a thumb rather than a great toe.

It remains to notice some of the most marked varieties of form which the bones of the F. present in mammals. Comparative anatomists give the same names to the bones which form the F. of other animals. As a general rule in all mammalia, the ecto-cuneiform supports the third or middle of the five toes when they are all present, the meso-cuneiform the second, and the cuboid the fourth and fifth. Bearing in mind this law, we see that the large bone in the horse, known as the cannon-bone, which is articulated to the ecto-cuneiform, is the metatarsal of the third toe, to which are articulated the three phalanges of that toe, the last phalanx being expanded to form the hoof. The small bone, popularly known as the splint-bone, and articulated to the meso-cuneiform, is the rudimentary or stunted metatarsal of the second toe; and the outer splint-bone, articulated to the cuboid, is the rudimentary metatarsal of the fourth toe; so that in the horse we have only one toe, the third, sufficiently developed to reach the ground, with mere traces of a second and fourth toe on either side.

In the F. of the ox, the cuboid is relatively larger than in the horse, and is equal in size to the ecto-cuneiform. The cannon-bone articulates with both these tarsal bones,

and hence answers to the metatarsal bones of both the *third* and *fourth* digits; it is accordingly found to consist of two distinct bones in the fetus; and in the adult it is divided internally into two cavities, and its original separation is marked out by an external elongated ridge. At the lower end are two distinct joints for the phalanges of the third and fourth toes. While in the horse we had the rudiments of the *upper* parts of two toes (the second and fourth), in the ox we have the rudiments of the *lower* parts or phalanges of two toes (the second and fifth), forming the "spurious hoofs." In the rhinoceros there is one principal toe (the third), as in the horse, with the second and fourth toes in a less developed state; while in the hippopotamus there are two principal toes (the third and fourth), as in the ox, with the second and fifth toes not fully developed. In the elephant, there is a fifth digit added, answering to our great toe, and articulating with an ento-cuneiform bone, so that in the F. of this animal we have all the bones occurring in the human foot.

Prof. Owen, to whose works we are indebted for these remarks, concludes from these and similar observations that the course of the simplification of the five-toed F. is, first, a diminution and removal of the innermost toe; next, of the outermost; then, of the second; and lastly, of the fourth; the third or middle toe being the most constant and (in the lower animals) the most important of the five,

FOOT, SOLOMON, 1802–66; b. Vt.; graduated at Middlebury college in 1826; principal of Castleton seminary, 1826–28; tutor in Vermont university, 1827; professor of natural philosophy in the academy of medicine at Castleton, 1828–31; admitted to the bar, 1831. He was a member of the state legislature, and, during his last three terms, speaker of the assembly. From 1843 to 1847, he was a member of congress, and from 1850 until his death, United States senator. He was for a number of years president *pro tempore* of the senate.

FOOTA-BONDOU. See BONDOU.

FOOTA JALLON, or FUTAJALLON, a district of Senegambia, Africa, around the sources of the Senegal, the Gambia, and the Niger; crossed by 13° n. and 13° w. It is a rough and mountainous country, but fertile in parts, producing corn, rice, fruits, oil, wine, wax, honey, etc. Iron is manufactured. The people are Mohammedans of the Foulah race, and are friendly with the whites, from whom they claim to be descended. There is trade with Timbuctoo and with coast towns. The government is elective. Capital, Timbo.

FOOTA TORO, a district forming the n. portion of Senegambia, Africa, on the Senegal river, in 15° to 16° n. It is flat, low, and hot, but fertile, with large forests. The pop. is estimated at 800,000, for the most part negroes and Mohammedans, who cultivate cotton and rice, and have a theocratic government. There are some large towns in the district, of which Medinalla, the capital, is the chief.

FOOTBALL. This game has long been a favorite throughout the British isles; and as a winter game, is far more popular than any other, especially in our universities and public schools. A large park or common is best suited for the game, one of the most attractive features of which is, that it may be simultaneously enjoyed by great numbers of players. There are at present two distinct styles of F., the one known as "the Rugby game," the other as "the association game," from its introduction and patronage by the F. association, instituted in 1863. In both games, the object is to drive the ball between certain bounds, placed at opposite ends of the ground—the game being played in the intervening space—and called *goals.* The goal is formed of two upright posts, which, in the Rugby game, are joined by a cross bar at a height of 10 ft., and in the association game by a tape at the height of 8 feet. The aim in the Rugby game is to drive the ball between the posts and *over* the cross-bar of the enemy's goal; in the association game, to drive it through the posts *below* the tape. Two side-lines, called *goal-lines,* are drawn from each of the goals, and the boundary of the playing-ground on each side is marked by a line called the *touch-line.* The opposing players take their positions opposite each other at different ends of the field. The game is decided by the number of goals won in a certain space of time, which is divided into equal parts, after each of which the players change ends.

The ball used is made of india-rubber bladder covered with strong leather.

In the Rugby game, the game is commenced by a *place-kick* (made by kicking the ball when placed on the ground) from the middle of the field. A goal may be won by a *drop-kick* over the adversary's goal, or by a place-kick resulting from a *touch-down* or a *fair-catch.* A drop-kick is made by dropping the ball from the hands, and kicking it as it rises. The touch-down is accomplished in the following manner: any player who catches the ball, either before it has touched the ground or on the bound, may run with it, if he can, till he gets behind the adversary's line of goal, where he will touch it down as near as he can to the goal, if possible between the posts. This feat is called *running in,* and secures the right of a place-kick at goal from any spot outside the goal-line in a straight line from where the touch-down was made. When the ball is touched down behind the goal-line, but not near the goal, a different mode of procedure, called the *punt-out,* is adopted. A fair-catch is a catch from a kick or from the hand, when the catcher makes a mark with his heel, and gets a free kick. When the ball crosses the touch-line at the side of the field, it is lifted and thrown out in a straight line to be

secured by either side. The player who has the ball may be *hacked* or kicked on the shins by those of the opposite side, so as to trip him over.

Under the association rules the main idea is to adhere as closely as possible to the literal meaning of the word football. Consequently, holding or carrying the ball is prohibited, and no one is allowed to use his hands at all, except the goal-keepers, who are allowed to protect the goal with their hands. Neither tripping nor hacking is allowed, and altogether the game is much less rough. The Rugby game is often played now without hacking.

FOOTE, a co. in s.w. Kansas, formed since the census of 1870; 720 sq.miles. It is crossed by the Arkansas river, and the Atchison, Topeka, and Santa Fe railroad. The surface is generally level, and the soil is fertile.

FOOTE, ANDREW HALL, 1806-63; b. Conn.; entered the navy in 1822; in 1833, was flag lieut. of the Mediterranean squadron. In 1838, he circumnavigated the earth in the *John Adams*, sloop-of-war, and was concerned in the attack on the pirates of Sumatra. In 1849, he was in the African squadron, actively engaged in suppressing the slave trade. In 1856, he commanded the *Portsmouth* on the China station, and arrived off Canton just in time to protect Americans and their property in the war then beginning between China and England. His ship was fired upon by the Canton forts, and the apology which he demanded was refused. He immediately attacked the forts, and captured the strongest of them by storm, the others afterwards surrendering. They were manned by 5,000 men, of whom 400 were among the killed and wounded, while Foote lost only 40 of his 280 men. In the war of the rebellion, he was in command of the Brooklyn navy-yard. Being capt. and flag officer of a fleet intended to operate in the western waters, he sailed from Cairo, Ill., Feb. 4, 1862, with seven gunboats, to attack fort Henry on the Tennessee. Two days afterwards he took the fort in an hour. On the 14th, he attacked fort Donelson on the Cumberland, but was unsuccessful. Although severely wounded, he went down the Mississippi and began the siege of island No. Ten, which he quickly reduced. In 1862, he was made rear-admiral, and was about to take command of the South Atlantic squadron when he died. He was the author of *Africa and the American Flag*, and *Letters on Japan*.

FOOTE, HENRY STUART, 1800-80; b. Va.; a graduate of Washington (Va.) college; admitted to the bar in 1822. In 1824, he started a newspaper in Tuscumbia, Ala. In 1826, he went to Mississippi, and in 1847, was chosen United States senator. He identified himself with the moderate Southern party, and favored compromise on the slavery question. In 1852, he became governor of Mississippi. In 1855-56, he was in California, acting with the "Know-Nothing" party; but he returned to Mississippi in 1858. He denounced secession while it was under discussion; but after the rebellion broke out he ardently upheld it, and was a member of the confederate congress, though a severe critic of Jefferson Davis. After the war, he resided in Washington. He was a man of ability, and a graphic writer, as was shown in his *Personal Reminiscences of Public Men*, and *Texas and the Texans;* but he was a quarrelsome politician, and fought several duels.

FOOTE, SAMUEL, actor and writer of comedy, was b. of a good family at Truro, in Cornwall, 1720. He was educated at Worcester college, Oxford, and about 1740 entered the Temple; but after a career of "pleasure," in the course of which he managed to dissipate two fortunes which had been left him, he turned to the stage as a means of support, and in 1744, made an unsuccessful début in the character of "Othello." In 1747, he opened the Haymarket theater—where he was at once director, actor, and dramatic author—with a piece entitled *Diversions of the Morning*. In this and other pieces, he introduced well-known living characters, and, by his admirable powers of mimicry, succeeded in drawing large audiences, till the theater was closed by order of the magistrates. After 1752, he continued to perform alternately in London and Dublin. In 1766, he broke his leg by a fall from his horse, and amputation was found necessary. He, however, recovered his health and spirits, and even turned the incident to account on the stage, composing parts expressly adapted to his own state. He died in 1777. Many comic anecdotes of F. are given in Cooke's *Memoirs of Samuel Foote* (1805). His conversation must have been inimitably comical. Dr. Johnson, who had a power of refusing to be pleased against his will greater than most men, met F. for the first time at Fitzherbert's, and assumed his most ursine manner; but it was no use: "I was obliged," he says, "to lay down my knife and fork, throw myself back in my chair, and fairly laugh it out. Sir, he was irresistible." His plays, four of the best of which are *An Auction of Pictures; The Minor; The Liar;* and *The Mayor of Garratt*, have been frequently published, but never in a complete form. See Forster's essay in the *Quart. Rev.*, 1854.

FOOTE, SAMUEL AUGUSTUS, LL.D., 1780-1846; b. Conn.; graduated at Yale in 1797, and practiced law. He was a member of congress 1819-23, and in 1833; speaker of the state assembly 1825-26; and senator of the United States 1827-33. He was the author of the famous resolution which provoked the great debate between senators Hayne of S. C. and Webster of Mass. This resolution, on which was based the most remarkable debate that has ever taken place in the country, was in itself of little moment, having reference merely to the survey of the public lands.

FOOT-GUARDS, the flower of the British infantry, and the garrison ordinarily of the metropolis, comprise three regiments, the grenadier, coldstream, and Scots fusilier guards, in all 7 battalions, and 6,307 officers and men. See GUARDS.

FOOT-POUND is the unit by which the *work done* by a force is estimated; thus (taking 1 lb. and 1 foot as the units of weight and distance), if 1 lb. be raised through 1 foot, the *work done* is equal to 1 foot-pound; if 10 lbs. be raised 9 ft., the *work done* is 90 foot-pounds; and generally, if W represent the *work done*, P the *weight in pounds*, and h the *height in feet*, then W (in foot-pounds) = Ph.

FOOT-PRINTS. See ICHNOLOGY.

FOOT-ROT amongst sheep is of two varieties, the commoner consisting of an inordinate growth of hoof, which at the toe, or round the margin, becomes turned down, cracked, or torn, and thus affords lodgment for sand and dirt. Insufficient wearing of the hoof is the obvious cause, and hence the prevalence of foot-rot in soft rich pastures, and especially amongst sheep previously accustomed to bare, rough, or upland walks, where the hoof is naturally worn down by the greater amount of walking necessary to procure sustenance. Taken in time, when lameness is first apparent, and before the hoof is cracked, and the foot inflamed, a cure rapidly follows the careful paring of the superfluous and diseased hoof; indeed, further treatment is scarcely necessary, unless any of the vascular parts have been laid bare, when a little tar may be applied as a mild astringent and protection from flies. When, from inattention or neglect, the hoof is separated from the sensitive parts beneath, when ulcers appear on the sole, or proud-flesh springs up, active astringents or mild caustics are necessary. The shepherd's old favorite, butter of antimony, diluted with an equal quantity of tincture of myrrh, is a good remedy when cautiously and temperately used. A convenient paste, which in inexperienced hands is safer than a fluid caustic, may be made with equal weights of flowers of sulphur and finely powdered sulphate of copper, rubbed up to the needful consistency with lard or oil. Many have great faith in a mixture of the salt of copper with gunpowder and lard.—The second and more troublesome variety is allied to what is termed *foul* in the foot; instead of commencing at the ground surface, it begins in the interdigital space, appears to depend upon constitutional rather than local causes, and frequently occurs along with the other variety, but, unlike it, occasionally becomes contagious. The foot is hot, tender, and swelled around and immediately above the coronet. There are ulcerations in the interdigital space, and the swelling, and subsequently the sprouting of proud-flesh, cause a separation of the toes. When the tenderness and heat are great, poultices are advisable; but in the milder cases and earlier stages, the parts should be well washed with a solution containing to the pint of water half an ounce each of suphuric acid and oil of turpentine. When ulcers appear, they must be touched with lunar caustic, or dressed with the paste already recommended.

FOOT-WASHING, an eastern custom of very early times, having its origin in necessities produced by climate and modes of dress, and in the obligations attached to the rites of hospitality. In the most primitive times, the feet were without covering and sandals afforded protection only to the sole. Consequently, after any journey in the heat and sand, bathing the feet, if not absolutely required, was at least convenient and refreshing. The custom prevailed in the days of Abraham as appears from his invitation to the travelers who approached his tent: "Let a little water be brought and wash your feet and rest yourselves under the tree." In like manner, Lot said afterwards to two of the same strangers: "Turn, I pray you, into your servant's house and tarry all night and wash your feet." From Scripture and other sources, we learn that the servants of a household were accustomed to perform this work for the guests, and thus it became a significant sign of humility. Knowledge of this custom, and of the facts connected with it, is necessary in order to appreciate that remarkable action which is recorded of the Savior, John xiii., at the last paschal supper, and which he himself instanced as a symbol of humility. In the east, abundant occasions arose for a literal imitation of the example. Many Christians became noted for kind hospitality to their fellow-disciples, of which provision for washing the feet was a customary part and a significant token of the whole. But the command gradually came to be obeyed in the letter only, and not in the spirit. Augustine speaks of the practice as kept up in his times, and also of doubts entertained concerning the proper day on which the ceremony ought to be performed. When it had become a ceremony to be performed only once a year, not only was the value of the observance reduced to its minimum, but great positive disadvantage attended it. In proportion as the spirit of the command was lost, its ceremonial was exalted and adorned. In 694, the synod of Toledo decided that the anniversary of the passover was the proper day for this observance. In the Greek church, foot-washing was elevated into a sacrament. In the Latin church, it was strenuously recommended as a sacrament for the remission of daily sins. In the middle ages, it was observed chiefly at the installation of bishops and coronation of princes. In Greek convents and at the Russian court, it is still practiced with great solemnity. In the papal court, in the regal courts of Vienna, Munich, Madrid, and Lisbon, and in Roman Catholic cathedrals and convents, it is observed to this day by washing the feet of twelve persons, generally poor old men. At Rome, in the Clementine chapel, at the beginning of the celebration, the strain, "A new commandment I give unto you," is

sung; the representatives of the apostles take their seats, dressed in white woolen tunics; and the pope, in similar attire, sprinkles a few drops of water on the right foot of each, then wipes and kisses it. After this, a repast is given, at which the pope and his cabinet wait on the old men, who, at the close, take with them the tunics and towels, with the addition of a small gratuity in money. Luther opposed this literal and restricted ceremonial as worthless, and inculcated rather a spirit of true humility and general helpfulness to all, according to actual opportunities and needs, saying—"If you wish to wash your neighbor's feet, see that your heart is humble and help every one in becoming better." The Anabaptists, at the reformation, continued the practice. The Moravians revived it, but without strictly enforcing it. Some minor modern sects have adopted it and attach great importance to its literal observance. The church of England, in its early days, imitated the letter of the command; but now in commemoration of it assemble annually at Whitehall, corresponding in number to the years of the sovereign's reign, a company of poor people, to each of whom are given clothes, food, and pieces of money equaling in number the years of age of the reigning monarch.

FORAGE (from Fr. *fourage*, a contraction of the barbarous Latin *fodderagium*, taken in its turn from the Gothic *fo-dur*, fodder), hay, straw, and oats supplied to horses of officers and soldiers in the army. Where troops are together, the provision of F. devolves on the commissariat: officers of the staff, etc., who are entitled to horses, but whose duties are at stations where bodies of horse are not collected, receive a money allowance, in lieu of F. in kind, varying according to the place and price of provender, but usually about 1*s*. 10*d*. to 2*s*. per horse per day. When a soldier is *en route* away from his regiment, the innkeeper with whom he stops is bound, under the mutiny act, to provide his horse with the specified ration of F.—viz., 10 lbs. oats, 12 lbs. hay, and 8 lbs. straw, for the payment of 1*s*. 9*d*. a day, which must also include stabling.

FORAGE (*ante*). The daily ration in the U. S. army is, for each horse 14 lbs. hay and 12 lbs. oats, barley, or corn. For a mule the same amount of hay with 9 lbs. grain. Leaves of Indian corn are used in default of hay. The consumption of forage during active army operations is enormous, and the weight is 4½ times as much as that of all other subsistence supplies. During the war of the rebellion, there were issued from the depot of Washington 4,500,000 bushels of corn, 29,000,000 bushels of oats, and 490,000 tons of hay. Partial reports of the quartermaster-general show issues of forage during the war as follows:

22,816,271 bushels of corn, costing	$29,879,314
78,663,799 bushels of oats	76,362,026
1,518,621 tons of hay, costing	48,595,872
Total	$154,837,212
The weight of these supplies in lbs. was—Corn	1,277,711,176
Oats	2,517,241,568
Hay	3,037,242,000

making a total of 6,832,194,744 lbs.—numbers interesting as showing the magnitude of the operations necessary to provide and distribute these few items of the expenses of war

FORAMINIF'ERA, a group of marine animals of very low organization, consisting of a gelatinous substance enclosed in a shell, which is generally calcareous, either simple or divided into chambers variously arranged, and pierced with pores or passages (*foramina*, whence the name), through which long delicate processes of the soft animal are protruded, but for what purpose is not very well known, whether to seize food, to imbibe nutritive fluid, for locomotion, or for all these purposes. Most of the species are minute, although one of more than 2 in. in diameter has been found in Borneo, and fossil forms approaching to this size are well known under the name of nummulites (q.v.), from their resemblance to coins. The existing species are very numerous, and have been distributed into many genera. They are found among sea-sand, and among all the dredgings of deep water. The fossil species are still more numerous, and constitute great part of some calcareous rocks, as of chalk. The F. are of very beautiful forms. Some of the simple ones are orbicular, some curiously flask-shaped; those in which the animal is divided into segments, and the shell consequently chambered, sometimes have the segments arranged in a straight line, sometimes spirally, sometimes alternately, etc. The great resemblance of some of the convoluted chambered shells of the F. to the shells of the genus *nautilus*, led Linnæus and many naturalists to rank them with that genus, and the F. were reckoned among the most highly organized mollusks, a place from which comparatively recent discoveries have completely removed them. They are now regarded as more nearly related to sponges and to such animals as the *proteus* or *amœba*. "The *foraminifera* are evidently composite fabrics evolved by a process of continuous gemmation, each gemma remaining in connection with the body by which it was put forth, and according to the plan on which this gemmation takes place will be the configuration of the shell."—Rymer Jones. Reproduction takes place by the detachment of minute granules in great numbers, and is apparently accompanied with the death of the parent. See PROTOZOA.

Fossil Foraminifera.—The earliest records of this order yet observed are in sandstones near St. Petersburg, belonging to the lower Silurian measures. Scattered through these sandstones are numerous green grains, which have been shown by Ehrenberg to contain, in their interior, silicious casts of shells similar to the recent genera *guttulina* and *textularia*. Forms, apparently referrible to the last genus and to *fusulina*, constitute a large portion of some beds of carboniferous limestone in Russia, and also in the United States. Among the secondary rocks, and especially in the chalk, F. are very abundant. Chalk, indeed, is composed almost entirely of the perfect or broken shells of *rotalia*, *spirulina*, *textularia*, etc. (see CHALK). They are not more numerous in the tertiary strata, but here they attain an enormous size—gigantic compared with any that preceded them, or with recent forms. Vast beds of limestone occur on the borders of the Mediterranean, composed almost entirely of these large forms. See NUMMULITES and NUMMULITE LIMESTONE.

FORBACH, a t. of Lorraine, Germany; the chief town of a circle, on an affluent of the Rossel, and on the Metz and Saarbrucken railway, 5¼ m. s.w. of Saarbrucken. Its industries include brewing, tanning, and the manufacture of glass, soap, and pasteboard. At a short distance from the town are large iron-works which employ 1500 workmen. There are also many extensive coal-mines in the vicinity. Forbach possesses schools of various grades, a Roman Catholic and two Protestant churches, and a synagogue. After the battle on the neighboring heights of Spicheren, Aug. 6, 1870, in which the French under gen. Frossard were defeated by the Germans under prince Frederick Charles, the town was occupied by the German troops, and at the conclusion of the war it was annexed to Germany.

FORBES, ALEXANDER PENROSE, 1817–75; b. Edinburgh; was the second son of lord Medwyn. He was partially educated at the Edinburgh academy, and studied under Rev. Thomas Dale, the poet, in Kent; he also attended the Glasgow university, and obtaining an appointment in the Indian civil service, left England for Madras. Returning to his native country in 1839, he obtained a Sanscrit scholarship in Brasenose college. At Oxford he became associated with Pusey, Newman, and Keble; and in 1844 was ordained deacon and priest in the church of England, and held a curacy. In 1846, he returned to Scotland for a while, but afterwards became vicar of Leeds. After the death of bishop Moir, he was called to the see of Brechin. He was ever zealous in labor, and untiring in the founding and extension of churches. He was once prosecuted for heresy, but he made a powerful defense, and was acquitted with censure and admonition. His *Treatises on the Nicene Creed* and *The Thirty-nine Articles*, and various commentaries, reviews, etc., were highly esteemed.

FORBES, DAVID, 1828–76; b. Douglas, Isle of Man. When a boy he manifested an enthusiastic delight in everything connected with science, and at the age of 14 had already acquired a remarkable knowledge of chemistry. This subject he studied at the university of Edinburgh, and he was still young when he was appointed superintendent of the mining and metallurgical works at Espedal in Norway. Subsequently, returning to England, he became a partner in a firm of nickel-smelters, and visited Chili, Bolivia, and Peru. Micro-petrology and chemical geology owe much to his researches. Besides reports for the iron and steel institute, of which, during the last years of his life, he was foreign secretary, he wrote upwards of 50 papers on scientific subjects, among which are the following: *The Action of Sulphurets on Metallic Silicates at High Temperature; The Relations of the Silurian and Metamorphic Rocks of the South of Norway; The Causes producing Foliation in Rocks; The Chemical Composition of the Silurian and Cambrian Limestones; The Geology of Bolivia and Southern Peru.*

FORBES, DUNCAN, of Culloden, a celebrated Scottish politician of the 18th c., and lord president of the court of session, was born either at Culloden or at Bunchrew—for the family possessed both estates—in the neighborhood of Inverness, on the 10th Nov. 1685. In 1704, the year that his father died, F., then a lad of 19, commenced his legal studies in Edinburgh; but the following year he removed to Leyden, then the great school for Scottish lawyers of revolution principles, where he studied for two years with the greatest diligence. In addition to the knowledge of the civil law, which was no doubt the principal object of his residence at Leyden, we are told that he made considerable progress in Hebrew and several other oriental languages. On his return from Leyden, F. was called to the bar, and almost immediately after appointed sheriff of Midlothian—a promotion the rapidity of which is somewhat inconsistent with modern usages. He rose rapidly into practice and into political influence through his connection with the great duke of Argyle, then in the zenith of his power, to whom he was united by family ties, and of whose estates he acted as a sort of manager. He married Mary Rose, the daughter of the laird of Kilravoc, a woman of beauty and accomplishment, to whom he is said to have been devotedly attached. She died shortly after their marriage, leaving him an only son, John, who eventually succeeded to his estate, but did not inherit his abilities. During both of the rebellions, Duncan F. acted a prominent part on the side of the Hanoverian government. In 1715, he was in the north, actively engaged in opposing the rebels, along with his elder brother John, who is said to have expended £3,000 on the royal cause, not one shilling of which was ever repaid him. But on this, as on all other occasions, Duncan's partisanship was

of the most moderate kind. After the suppression of the rebellion, he was opposed to the project of carrying the prisoners out of Scotland, to be tried by English juries, and he wrote to lord Islay, when he heard that it was proposed to appoint him lord advocate, that he should certainly decline that office. He wrote to his brother, proposing a subscription for the comfort of the prisoners. "It is certainly Christian," he said, "and by no means disloyal, to sustain them in their indigent state till they are found guilty." To the forfeitures also he was opposed, on grounds of policy as well as of humanity. The only effect of his moderation was to bring suspicion on his own loyalty. But he was too important for his promotion to be arrested. In 1716, he was appointed depute to the lord advocate; in 1722, he was returned to sit in parliament for the Inverness district of burghs; and in 1725, he was lord advocate. He was not distinguished as a debater, but he was largely employed at this period of his career in appeal cases, and he enjoyed the friendship of sir Robert Walpole, Lyttleton, Mansfield, and Hardwick. He seems even to have penetrated the literary circles in which Swift, Pope, and Arbuthnot were the ruling stars. In 1734, his brother John—Bumper John, as he was called—died, and he succeeded to the estates of the family. In earlier life, Duncan partook of the convivial habits for which his family was distinguished, in an age that was famous for deep potations. Mr. Burton records various anecdotes illustrative of his powers in this direction, but he abandoned the practice when his health began to suffer, and devoted himself to more serious if not more onerous duties. During many subsequent years, he in no insignificant degree ruled the destinies and contributed to the dawning prosperity of Scotland by fostering and developing her internal resources. His policy was to extinguish the rebellion by gaining over the Jacobites to the government. The purity and uprightness of F.'s character were subjected to a severe test. His whole correspondence during these troubled times came to light some seventy years after his death; and though few men ever wrote or were written to with less idea of publication, "we have not been able," says Mr. Chambers (*Biographical Dictionary of Eminent Scotsmen*), "to detect a single one of his advices or proceedings, by the exposure of which even a private gentleman of the most delicate honor, and the most reasonable views, would have cause to feel a moment's uneasiness. Having freed himself from the shackles of party, his great object was to improve the trade and agriculture of the kingdom. But his views of political economy were not greatly in advance of his time; for in order to encourage the use of malt, he presented to the government a long and detailed scheme for preventing or rather for punishing the use of tea. F. was appointed president of the court of session in 1737; but he still continued his interest in the general improvement of the country. Though he was aware of the character, and, in general, of the designs of the Jacobites, the rebellion of 1745 took the president by surprise. But he was no sooner aware of the danger than he hastened to the north, as he had done on the occasion of the former outbreak, and by his presence and the influence which he possessed in his own district, did much to counteract the proceedings of the rebels. Lovat, as is well known, betrayed both him and the government, and actually made an attack on Culloden house, from which he was beaten off with great spirit by the president and his people. When the rebellion spread, he was forced to abandon his house, and take refuge in the island of Skye, where he remained till after the battle of Culloden. On his return, in place of reaping the fruits of his services, he was regarded with jealousy and aversion by the government. Even the large sums of money which he had advanced were never repaid him; and it is said that the ingratitude of the government, coupled with the perfidy of many of his friends and neighbors, who had changed sides more than once during this miserable affair, weighed so heavily on his spirits as to shorten his life. He discharged his judicial duties, however, with great zeal and ability till within a month of his death, which took place on Dec. 10, 1747. The parliament house in Edinburgh contains a beautiful portrait and a fine statue of the lord president F., who was a man of great elegance of person and manner. The most complete biography of F. is that of Mr. Burton in his lives of Simon lord Lovat and Duncan Forbes, 1848.

FORBES, EDWARD, an eminent naturalist, was b. at Douglas, isle of Man, Feb. 12, 1815, and d. in Edinburgh, Nov. 18, 1854. He received a desultory and imperfect education in early life, in consequence of ill health; but when he left home at the age of 16, he had already possessed himself of a very considerable amount of knowledge in the departments of botany, zoology, and geology. In 1831, F. went to London, with the intention of becoming a student at the royal academy; but although he evinced much readiness in drawing, his artistic talents were not sufficiently marked to hold out any prospect of success in the event of his making art his profession; and he therefore determined to turn his attention to medicine, and with this view, entered the university of Edinburgh. In 1836, he finally relinquished his special medical studies, to devote himself exclusively to the natural sciences. In 1836–37, he attended lectures at Paris, where he studied under Geoffroy St. Hilaire, Jussieu, and De Blainville, while he at the same time availed himself with diligence of all the advantages afforded to students by the museums and libraries of Paris. From the first year of his college life, F. had spent his summer vacations in rambles over various parts of Great Britain, or in excursions on the continent, and the results of the observations which he made during these

tours, which were published by him either in the form of separate works, or in the pages of current scientific journals, sufficiently attest his diligence as an observer, and his exact appreciation of analogies and differences of forms. F. may almost be regarded as the originator of the use of the dredge, which he employed with equal success in investigating the marine fauna of our own seas, and of the Mediterranean and the Ægean. In 1841, he joined the surveying ship *Beacon*, as naturalist, and accompanied that vessel during the survey of a part of Asia Minor, and co-operated in the exploration of many of the Xanthian cities. On his return to England in 1843, he found that he had during his absence, been elected to the chair of botany, king's college, London. He was soon afterwards named curator of the geological society; and from that period till his removal to Edinburgh, he remained in London, living in a vortex of scientific labors and literary work. In 1844, he was appointed paleontologist to the museum of geology in connection with the ordnance geological survey; and in 1851, on the opening of the new buildings in Jermyn street, London, he was named professor of natural history in the school of mines. In 1852, he was chosen president of the geological society, an honor never before conferred on so young a man; and in 1853, on the death of prof. Jameson, he was elected to the vacant chair of natural history in the university of Edinburgh. In the summer of 1854, he delivered a short course of lectures—the only one he was destined to give—for at the commencement of the winter session he was seized with a severe illness, which speedily proved fatal, and terminated his life in the 39th year of his age, in the very zenith of his fame, and in the full vigor of his intellectual powers. F. had been a voluminous writer and a diligent observer of nature from his earliest youth, and had collected an immense mass of materials, many of which were, however, left at his death in a disorganized condition. He did much to advance and systematize special departments of natural history, both by his own labors and by the stimulus which he imparted to his associates and pupils; and it would be difficult to instance any naturalist who has exercised a greater influence on the thought and line of inquiry pursued by those who have cultivated the same branches of knowledge. His classification of the British *star-fishes* opened a new era in that branch of zoology; and his discovery that air-breathing mollusks lived at the period of the Purbeck beds, has been the means of rectifying many erroneous hypotheses, and throwing unexpected light on several hitherto obscure points of geology, while the inferences which he drew from the presence of those animals have been fully corroborated. His report on the Ægean sea, and his observations of the tertiaries of Cos, which have proved of great value to geology, raised him to the highest rank among living naturalists. From an early period, he had directed his attention to the distribution of animal and vegetable life in different zones of the sea and land, and his observations in this path of inquiry have opened many new fields of research. F. was a diligent contributor to the current scientific literature of the day, and many of his best papers were written for the meetings of the British association, of which he was an active member, and for the various societies with which he was connected; while he also took a most efficient share in the labors of the ordnance survey during his connection with its staff. His separate works, papers, and monographs, of which upwards of 200 are published, and many of which are copiously illustrated by his own beautiful drawings, cannot be individually specified; but among them we may instance the following: *On the Distrib. of Pulmonif. Mollusca in Europe* (1838); *Malacol. Monensis* (1838); *Star Fishes* (1841); *The Radiata and Mollusca of the Ægean* (1843); *Travels in Lycia* (written in conjunction with lieut. Spratt, 1846); *Naked-eyed Medusæ* (1847); *British Mollusca* (1853, 4 vols. 8vo, conjointly with S. Hanley); the map of *Homoiozoic Belts* (Johnston's *Phys. Atlas*, 1854); *Collection af Literary Papers by E. Forbes* (1855); etc. See *Memoir* by G. Wilson and A. Geikie, 1861.

FORBES, James David, principal of the united college in the university of St. Andrews, a grandson of sir W. Forbes, the banker, was b. at Colinton, near Edinburgh, April 20, 1809. He studied in the university of Edinburgh from 1825 until 1830, when he was admitted to the Scottish bar. On the death of sir John Leslie (q.v.), he was appointed, in 1833, to the chair of natural philosophy in the university of Edinburgh, after a contest in which, among other competitors, he was opposed by Dr. (afterwards sir David) Brewster and Mr. Galloway. In 1842, the institute of France enrolled him among its corresponding members. He was, besides, a member of numerous other scientific societies at home and abroad, received the royal and the Rumford medals from the royal society of London, and two Keith medals from the royal society of Edinburgh, and was D.C.L. of Oxford. In 1860, F. resigned his chair in Edinburgh, to become principal of the united college in the university of St. Andrews. Among his contributions to science are—the polarization of radiant heat by the tourmaline, and also by reflection (1836), and its circular polarization—discoveries forming some of the strongest proofs of the identity of calorific and luminous rays; the unequal polarization of heat from different sources (1844); the refrangibility of heat; the depolarization of heat; etc. This whole series of experimental results is of a very high order of importance. He is, however, best known to the world in general by his researches on the motion of glaciers. See *Travels in the Alps* (1843); *Norway and its Glaciers* (1853); *Tour of Mont Blanc and Monte Rosa* (1855); and *Occasional Papers on the Theory of Glaciers* (1859). He was undoubtedly the first to establish the great *fact*, that glacier ice moves in its

channel like a viscous fluid, the middle moving faster than the sides, and the upper portions faster than the lower. See GLACIERS. In meteorology, F., among other things, improved Wollaston's application of the thermometer to the determination of heights, and verified with great care Fourier's theoretical results concerning the temperature of the ground at different depths and in different kinds of soil and rock. F. also contributed numerous valuable papers to the *Transactions of the Royal Societies of London and Edinburgh*, to the *Edinburgh Philosophical Journal*, and other periodicals. He died Dec. 31, 1868. His *Life and Letters*, edited by principal Shairp of St. Andrews, prof. Tait of Edinburgh, and Mr. Adams Reilly, the Alpine traveler, was published in London, 1873.

FORBES, JOHN, 1710–59; b. Scotland; became an officer in the Scottish grays in 1745. He served in the German war; then came to America and was made brig.gen. In Nov., 1758, he took possession of the French fort Du Quesne at the junction of the Ohio and Monongahela, and named the place Pittsburgh, after the elder Pitt, then prime minister of England.

FORBES, Sir JOHN, an eminent physician, was b. Oct. 18, 1787, at Cuttlebrae, Banffshire, and died Nov. 13, 1861. After studying at Aberdeen and Edinburgh, he entered the navy in 1807 as assistant-surgeon, and continued on active duty till 1816, when he finally left the service. In 1817, he took the degree of M.D. at Edinburgh, and soon afterwards settled as a physician at Penzance, from whence he removed in the course of a few years to Chichester. In 1840, F. went to London, where he speedily obtained a large practice. He was knighted in 1853 by the queen, to whose household he held the appointment of physician in ordinary, while he was at the same time physician extraordinary to prince Albert. He was a fellow of the college of physicians, and the royal society of London; D.C.L. of Oxford, and a member of numerous foreign societies. F., conjointly with Drs. Tweedie and Conolly, was the editor of the *Cyclopædia of Practical Medicine*, which, in addition to the numerous contributions of the editors, included the labors of more than sixty British physicians, of the first rank. This work, which has exercized a most beneficial influence both on the theory and practice of medicine, was completed in 4 vols. 8vo, in 1835. In 1836, F. founded the *British and Foreign Medical Review*, which he carried on with great success for twelve years. The services which he thus rendered to his brother-practitioners placed him deservedly among the foremost of his profession. To F. in a great measure belongs the merit of having introduced the use of the stethoscope in England, and of having successfully directed the attention of British practitioners to the art and practice of physical diagnosis. In 1831, he published the first edition of his translation of Laënnec's *Treatise on Auscultation;* and in 1838, when the fifth edition appeared, the new method was already extensively used. F. was a ready and pleasant writer, as is amply shown by the various records of his summer rambles; among which we may instance his *Physician's Holiday* (1849), and his *Sight-seeing in Germany and the Tyrol* (1856). His last professional work, entitled *Nature and Art in the Cure of Diseases* (1857), contains a systematic exposition of his medical opinions and doctrines.

FORBES, JOHN MURRAY, D.D., b. 1807; graduated at Columbia college in 1827, and at the Episcopal theological seminary, in 1830. In 1834, he became rector of St. Luke's church, New York, and was for a time professor of pastoral theology and pulpit eloquence in the pastoral theological seminary. In 1844–47, he was a delegate to the general conference of the church. In 1849, he, about the same time with John Henry Newman and Henry Edward Manning, went over to the Roman Catholic church. Both the Englishmen are now (1880) cardinals. In 1852, Forbes was appointed by the bishop of South Carolina his theologian in the plenary council of the Roman Catholic church held at Baltimore, and in 1854 he acted in the same capacity for the bishop of Boston in the provincial council held in New York. In 1859, he returned to the Protestant Episcopal church, and gave his reasons for so doing in a letter to archbishop Hughes, of which a portion follows: "It is now nearly ten years since, under your auspices, I laid down my ministry in the Protestant Episcopal church to submit myself to the church of Rome. The interval, as you know, has not been idly spent; each day has had its responsibility and duty, and with these have come experience, observation, and the knowledge of many things not so well understood before. The result is, that I feel I have committed a grave error, which, publicly made, should be publicly repaired. When I came to you, it was, as I stated, with a deep and conscientious conviction that it was necessary to be in communion with the see of Rome; but this conviction I have not been able to sustain, in face of the fact that by it the natural rights of man and all individual liberty must be sacrificed; not only so, but the private conscience often violated, and one forced, by silence at least, to acquiesce in what is opposed to moral truth and justice. Under these circumstances, when I call to mind how slender is the foundation in the earliest ages of the church upon which has been reared the present papal power, I can no longer regard it as legitimately imposing obligations upon me or any one else. I do now, therefore, by this act, disavow and withdraw myself from its alleged jurisdiction." In 1862, he was, by special favor, restored to the Protestant Episcopal ministry, and in 1869 was made an officer of the general theological seminary.

FORBES, Sir WILLIAM, of Pitsligo, Bart., an eminent Scottish banker, son of sir William Forbes, bart., advocate, was born in Edinburgh, April 5, 1739. He succeeded his father when only 4 years old, and received his education at Aberdeen. In his 15th year, he was introduced into the bank of Edinburgh of Messrs. John Coutts & Co.; and in 1871, was admitted a partner. In 1763, one of the brothers Coutts having died, while another retired on account of ill health, and two others were settled as bankers in London, a new company was formed, consisting of sir William Forbes; Mr. Hunter, afterwards sir James Hunter Blair; Mr., afterwards sir Robert Herries; and Messrs. Stephen and Cochrane. They at first carried on business in the name of the old firm. On 1st Jan., 1773, however, on some changes in the partnership taking place, the name was changed to that of sir W. Forbes, J. Hunter & Co., and of this firm sir William continued to be the head till his death. In 1781, he purchased the estate of Pitsligo, Aberdeenshire, which had been forfeited by lord Forbes of Pitsligo for taking part in the rebellion of 1745. Animated by genuine patriotism and public spirit, he introduced the most extensive improvements on it, and laid out and built the village of New Pitsligo. He was a member, with Johnson, Burke, Garrick, Reynolds, and others, of the celebrated literary club of London, and the author of a life of his friend, Dr. Beattie, the poet, published, with his works, in 2 vols., 4to, in 1805; also of *Memoirs of a Banking House*, being the history of his own, edited by Mr. Robert Chambers (Edinburgh, 1860). He died at his seat near Edinburgh, Nov. 12, 1806, aged 68. By his wife, Elizabeth, eldest daughter of sir James Hay of Hayston, bart., he had three sons and five daughters. Universally esteemed and respected, his character is well described by sir Walter Scott in the introductory address of one of the cantos of *Marmion*. His bank became, in 1830, the Union Bank of Scotland.

FORBES MACKENZIE ACT. The statute, popularly known by the name of the gentleman (Mr. Forbes Mackenzie, M.P. for Peeblesshire) who introduced the bill, is the 16 and 17 Vict. c. 67 (1853), entitled "An act for the better regulation of public-houses in Scotland." This act retained in general the provisions of 9 Geo. IV. c. 58, by which the granting of certificates by justices of the peace and magistrates, authorizing persons to keep common inns, ale-houses, and victualing-houses in Scotland was regulated. But it prohibited the granting of certificates for excisable liquors to be "drunk on the premises," unless on the express condition that no groceries or other provisions to be consumed elsewhere should be sold in the house or premises with respect to which such certificate is granted. The object of this portion of the enactment being to prevent grocers from becoming in reality the keepers of tippling-houses, those persons continued to be permitted to sell liquors by retail, provided that they were not consumed in their shops. In accordance with the principle of distinguishing between the different classes of houses in which the trade of a spirit-dealer should be carried on, three different grades of licenses were introduced: those applicable, viz., 1, to inn or hotel keepers; 2, to public-house keepers; and 3, to grocers and provision-dealers. As regards the first class, it is enacted that they shall not "keep open house, or permit or suffer any drinking in any part of the premises belonging thereto, or sell or give out therefrom any liquors before eight o'clock in the morning, or after eleven o'clock at night of any day, with the exception of refreshments to travelers, or persons requiring to lodge in the said house or premises; and further, that they shall not open their houses for the sale of any liquors, or sell or give out the same on Sunday, except for the accommodation of lodgers and *boná-fide* travelers." The same restrictions are imposed on the second class of persons—viz., the keepers of public-houses, with this addition, that no exception is made in their case in favor of travelers or lodgers; whilst grocers and provision-dealers, in addition to the prohibition to open on Sundays, and that already mentioned with reference to the consumption of spirits on the premises, are forbidden "to sell or give out any liquors before six o'clock in the morning, or after eleven o'clock at night." Separate licenses were also introduced for the sale of malt liquors from those applicable to the sale of wine and spirits, all of which had formerly been included under one license. By this statute, also, for the first time in Scotland, the very formidable power was conferred on the police of entering at any time any public-house, or house where refreshments are sold to be consumed on the premises, and penalties were awarded against those who refused to admit them, or who obstructed their entrance. These provisions having given rise to much discussion, a royal commission to inquire into the working of the act was issued on the 25th April, 1859. The result of the commission was the issue, as usual, of two enormous volumes of printed evidence, and of a report, more distinguished for its length than for the value of the suggestions which it contains. The commissioners arrived at the conclusion, that "although intemperance still prevails to a lamentable extent, it would seem that this vice has been for some time gradually descending in the scale of society, and that it is now chiefly confined to the lowest class of the population." This effect the commissioners ascribe to several causes, of which the first and most important is the increase of the duty on excisable liquors from 2*s*. 4¾*d*. per imperial gallon, at which it stood in 1823, to 8*s*., to which it had been raised in 1855. Nor do they deny to the Forbes Mackenzie act its share of merit. "The beneficial effect of the act," they say, "is proved by the evidence which we received as to the diminution of crime, and the change for the better in the habits of the people, imme-

diately after the passing of the act, when its provisions were strictly enforced, and by the tendency in an opposite direction which in some places has followed its less rigorous enforcement. Whilst thus generally approving of the act, the commissioners suggest a number of alterations, mostly with the view of enabling the police to carry out its provisions with greater efficiency. In reference to the difficulty experienced by hotel-keepers in ascertaining what persons come under the description of *bona-fide* travelers, the commissioners recommend that "persons inducing hotel-keepers to sell or give out excisable liquors to them on Sunday, by falsely representing themselves as travelers, should be guilty of an offense, and be liable, on conviction, to a fine." This recommendation was given effect to in the public-houses amendment Scotland act 1862, which imposes a penalty of £5 or thirty days' imprisonment on persons obtaining excisable liquor on false representations on Sunday, or before opening or after closing hours. In these circumstances, it becomes important to know that it has been decided in England that to constitute a "traveler" within the meaning of the corresponding act 18 and 19 Vict. c. 118, s. 2, it is a matter of indifference whether the parties be traveling for business or pleasure, and that a walk, ride, or drive, for exercise and amusement of such length as to render refreshments desirable, is a sufficient journey. In Atkinson *v.* Sellers (5 C. B. N. S. 442), chief-justice Cockburn remarked, that "a man could not be said to be a traveler who goes to a place merely for the purpose of taking refreshment. But if he goes to an inn for refreshment in the course of a journey, whether of business or of pleasure, he is entitled to demand refreshment, and the innkeeper is justified in supplying it." See also Taylor *v.* Humphreys, C.P. 705; 4 L. T. N. S. 814. The first was in the case of a drive from Liverpool of 5½ m., the second of a walk from Birmingham of 4 miles.

FORBIDDEN FRUIT, a name fancifully given to the fruit of different species of *citrus*. In the shops of Britain, it is a small variety of the shaddock (q.v.) which generally receives this name. But on the continent of Europe, a different fruit, regarded by some as a variety of the orange, and by some as a distinct species (*citrus paradisi*), is known as the F.F., or Adam's apple. Like some other fruits of the same genus, it was recently introduced into the s. of Europe from China. The tree has broad, tapering, and pointed leaves, the leaf-stalks winged; the fruit is large, somewhat pear-shaped, greenish-yellow, of very uneven surface, having around its base a circle of deeper depressions, not unlike the marks of teeth, to which it probably owes its name. It is chiefly the rind which is the edible part; the rind is very thick, tender, melting, and pleasant; there is very little pulp; the pulp is acid.

The name F. F. has also been given to the fruit of *tabernæmontana dichotoma*, a tree of Ceylon, of the natural order *apocynaceæ*. The shape of the fruit—which is a follicle, containing pulp—suggests the idea of a piece having been bitten off, and the legend runs that it was good before Eve ate of it, although it has been poisonous ever since.

FORCE—ENERGY. Till we know what matter (q.v.) is, *if there be* matter, in the ordinary sense of the word, at all, we cannot hope to have any idea of the absolute nature of force. Any speculations on the subject could only lead us into a train of hypotheses entirely metaphysical, since utterly beyond the present powers of experimental science. If we content ourselves with a definition of force based on experience, such a definition will say nothing of its nature, but will confine itself to the effects which are said to be due to force, and in the present state of our knowledge it is almost preposterous to aim at more.

Our first ideas of force are evidently derived from the exertion required to roll, or lift, bend, or compress, etc., some mass of matter; and it is easy to see that in all such cases where muscular contraction is employed, matter is moved, or tends to move. Force, then, we may say generally, is *any cause which produces, or tends to produce, a change in a body's state of rest or motion*. See MOTION, LAWS OF. The amount or magnitude of a force may be measured in one of two ways: 1. By the pressure it can produce or the weight it can support; 2. By the amount of motion it can produce in a given time. These are called respectively the statical and dynamical measures of force. The latter is, as it stands, somewhat ambiguous. What shall we take as the quantity of motion produced? Does it depend merely on the velocity produced? or does it take account of the amount of matter to which that velocity is given? Again, is it proportional to the velocity itself, or to its square? This last question was very fiercely discussed between Leibnitz, Huyghens, Euler, Maclaurin, the Bernouillis, etc.; Leibnitz being, as usual with him in physical questions, on the wrong side. Newton, to whom we owe the third law of motion, had long before given the true measure of a force in terms of the motion produced. This law is an experimental result—that when pressure produces motion, the *momentum* produced (see MOMENTUM) is proportional to the pressure, and can be made (numerically) equal to it by employing proper units. Hence momentum is the true dynamical measure of force, which, therefore, is proportional to the *first* power only of the velocity produced. What is properly measured in terms of the *square* of the velocity, we shall presently see. For various properties of force, statical and dynamical, see the following articles: COMPOSITION OF FORCES, COUPLES, CENTER OF GRAVITY, CENTRAL FORCES, FALLING BODIES, MECHANICAL POWERS, VIRTUAL VELOCITIES.

It is obvious that in order to produce any effect at all, or to do WORK, as it is techni-

cally called, a force must produce *motion*, i.e., must move its point of application. A weight laid on a table produces no effect whatever unless the table yields to the pressure, i.e. unless the weight descends, be it ever so little. We do no work, however much we may fatigue ourselves, if we try to lift a ton from the floor; if it be a hundred-weight only, we may lift it a few feet, and then we shall have done work—and it is evident that the latter may be measured as so many pounds raised so many feet—introducing a new unit, the FOOT-POUND, which is of great importance, as we shall shortly see, in modern physics. See WORK. This is evidently, however, a statical measure of work, since no account is taken of velocity. Have we then for work, as we had for force, a *dynamical* measure? Let us take a simple case, where the mathematical investigation is comparatively very easy, and we shall find we have. We know (see VELOCITY; MOTION, LAWS OF) that if a particle be moving along a line (straight or not) and the distance moved (in the time t) along the line from the point where its motion commenced be called s, its velocity is $v = \frac{ds}{dt}$. Also we know that the force acting on it (in the direction of its motion) is to be measured by the increase of momentum in a given time—this gives (just as the last equation was obtained) $F = m\frac{dv}{dt}$. From these two equations, we have, immediately, $mvdv = Fds$, or, as the rudiments of the differential calculus give at once, $\frac{mv^2}{2} = \int Fds = F.s$ if the force be uniform.

The quantity on the right-hand side is the sum of the products of each value of F, by the corresponding space ds, through which the particle moved under its action. It is therefore the whole work done by the force. On the left hand, we find half the product of the mass, and the square of the velocity it has acquired; in other words, the vis-viva. Hence, in this case, the vis-viva acquired *equals* the amount of work (q.v.) expended by the force.

It appears from a general demonstration (founded on the experimental laws of motion, and therefore true, if they are), but which is not suited to the present work, that if, in any system of bodies, each be made up of particles or atoms, and if the forces these mutually exert be in the line joining each two, and depend merely on the distance between them, then we can express the required proposition in the following form:

Any change of vis-viva in the system corresponds to an equal amount of work gained or lost by the attractions of the particles on each other.

What is spent, then, in work, is stored up in vis-viva; and conversely, the system, by losing some of its vis-viva, will recover so much work-producing power. If we call the former, as is now generally done, *kinetic*, and the latter *potential*, *energy*, we may express the above by saying, that in any system of bodies where the before-mentioned restrictions are complied with, *the sum of the kinetic and potential energies cannot be altered by the mutual action of the bodies.* The most simple and evident illustrations of this proposition are to be found in the case of the force known as gravitation. The potential energy of a mass on the earth's surface is zero, because, not being able to descend, it has, in common language, no work-producing power. If it be raised above the surface, and then dropped, it is easy to see that the work expended in raising it will be exactly recovered as vis-viva after its fall. For (see FALLING BODIES) a mass falling through a space, h, to the earth acquires a velocity v, such that $v^2 = 2gh$, or if m be the mass, $\frac{mv^2}{2} = mg.h$. The left-hand side gives the vis-viva acquired by the fall—the right is the product of the weight (mg) and the height fallen through—or is the work required to elevate the mass to its original altitude.

Hence we may calculate the amount of work which can be obtained from a *head* of water in driving water-wheels, etc., remembering, however, that there is always a *loss* (as it is usually called) due to friction, etc., in the machinery. That there is a loss in useful power, is true, but we shall find presently that in energy there is none, as indeed our general result has already shown. *Where* the apparently lost energy goes, is another question.

Another good example of potential energy is that of the weights in an ordinary clock. It is the gradual conversion of potential into kinetic energy in the driving weight which maintains the motion of the clock, in spite of friction, resistance of the air, etc.; and we have in the kinetic energy of sound (which depends on vibrations in the air) a considerable portion of the expended potential energy of the striking weight. A coiled watch-spring, a drawn bow, the charged receiver of an air-gun, are good examples of stores of potential energy, which can be directly used for mechanical purposes.

The chemical arrangement of the different components of gunpowder, or gun-cotton, is such as corresponds to enormous potential energy, which a single spark converts into the equivalent active amount. But here, *heat* has a considerable share in the effects produced; it may then be as well, before proceeding further, to consider how we can take account of it, and other (so-called) physical forces, as forms of energy.

Correlation of Physical Forces.—So far as we yet know, the physical forces may be thus classified: I. GRAVITATION (q.v.); II. MOLECULAR FORCES—COHESION (including CAPILLARITY), ELASTICITY, CHEMICAL AFFINITY; III. HEAT AND LIGHT; IV. ELEC-

TRICITY (including MAGNETISM); V. ANIMAL FORCE; VI. VITAL FORCE, having, as some most irrationally suppose, an analogue in inorganic masses, which may be called crystalline force. (This idea is examined further on.) Of these, I., II., and some forms of III., are more immediately connected with *matter* than the others—that is to say, that the remainder almost necessitate the hypothesis of the existence of some medium unlike ordinary matter, or, in popular language, an *imponderable*. The almost universal opinion of physicists, however, seems to be, that even the former must be accounted for in some such way. Newton, in his second letter to Bentley, says, with respect to gravitation (and it is obvious that similar language is applicable to molecular forces generally): "You sometimes speak of gravity as essential and inherent to matter. Pray, do not ascribe that notion to me, for the cause of gravity is what I do not pretend to know." And again in the third letter: "It is inconceivable that inanimate brute matter should, without the mediation of something else, which is not material, operate on, and affect other matter without mutual contact, as it must do, if gravitation, in the sense of Epicurus, be essential and inherent in it; and that is one reason why I desired you would not ascribe innate gravity to me. That gravity should be innate, inherent, and essential to matter, so that one body may act upon another at a distance through a *vacuum*, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it. Gravity must be caused by an agent acting constantly according to certain laws; but whether this agent be material or immaterial, I have left to the consideration of my readers." Of what that medium may consist, we cannot, of course, hazard even a conjecture; but if it be composed of separate atoms—i.e., not continuous—it is evident that a second medium will be required to help the particles of the first to act on each other (for without this, the first medium would be merely obstructive), and so on. This must stop somewhere; why not, then, at the first? But in the present state of our knowledge of mechanics, a continuous medium is barely conceivable, and its motions, etc., present considerable difficulties to even plausible mathematical treatment. If we take the view opposed to Newton's, as Mosotti and others have done (their ideas are considered further on), we can, in a very artificial manner, however, account for gravitation and molecular action; but, as before said, the foundations of this attempt at explanation are hardly tenable.

Just as sound depends on the elasticity of the air and vibrations thereby maintained and propagated, light and radiant heat, which are certainly identical, most probably consist in the vibrations of some very elastic fluid. This has been provisionally named ether (q.v.). If it be continuous, it may help us to account for the first two categories of force also, as we have already seen; if not so, as is more likely, fresh difficulties arise. Light and heat, however, undoubtedly depend on motion, and correspond, therefore, to so much vis-viva or actual energy. Even heat in a liquid or solid body must correspond to some vis-viva in the material particles, since a hot body can give out both light and heat, and a body may be heated by luminous or calorific rays which are vibratory, as we have seen.

Class IV. contains perhaps the most puzzling of all these forces. That there is something in common in all the forms of electricity, and that magnetism is nearly related to them, is certain; it is probable, also, that frictional electricity, when statical, consists in something analogous to a coiled spring, or is a form of potential energy—the others being forms of kinetic energy. Some have supposed magnetism to be also a form of potential energy, but Ampère's discoveries have materially lessened the probability of the truth of this hypothesis. We shall consider this again.

Class V. may be deferred for the present.

As to Class VI., it seems, from the observations of physiologists as to the formation of cellular matter, and the production in living organisms of compounds which have not yet been made by ordinary chemical processes, that the vital force, if there be such, is not a force which does work, in the mechanical sense of the term, but merely *directs*, as it were, the other natural forces *how to apply* their energies. Were a railway train running on a smooth horizontal line of rails, it would retain forever its original velocity; but in turning a curve, it would be acted on by deflecting forces, without which its path would be straight. These forces *do no work*, as is evident, since this would be shown in alteration of the vis-viva, and none takes place. They modify, however, the direction in which the train moves.

When gangs of laborers and masons are at work building an edifice, the former are employed raising stones, mortar, etc., the latter in laying them; but there is present an overseer with a plan, who, doing no (mechanical) work himself, guides and directs the proper application of force by the working body. In this view of the case, the laborers are the physical forces, and the overseer the vital force. It is quite certain that the so-called crystalline force cannot properly be put in this category, as presenting even an analogy, however slight; it is probably an effect, not a cause, and due to the different forms of simple or compound particles of matter, and the consequent variations in their molecular forces in different directions.

So far, then, for the possible nature of the forces, which, with the probable exception of VI., certainly depend on various forms of energy. Can these be transformed

one into another, as the different kinds of mechanical energy can? Take the potential energy of gravitation to begin with. We can employ it to drive a water-wheel. This turns a shaft, to which, if a tight brake be applied, heat will be produced by friction, and light also, if a rough wheel on the shaft be made to rotate against a piece of flint or pyrites; or electricity may be produced by employing the moving power to turn an ordinary electrical machine, or a magneto-electric one; and from the electricity so produced, electrical charges and currents may be derived; from them heat and light again. Or the currents may be employed to magnetize a needle or a piece of soft iron, or to produce chemical decomposition.

Again, heat may be employed by means of a steam-engine as a substitute for the water-power or potential energy of gravitation, and the above effects be produced. It may also be employed in raising weights, and therefore in producing the potential energy in question; or it may be employed to produce thermo-electric currents, and thence all the ordinary effects of electricity, including the motion of a magnetic needle.

Light may be employed to produce chemical combination or decomposition, as we see in photography; it may also by the same means be made to produce electric currents, and consequent *motion* of a needle. It is not yet proved that light can produce magnetism *directly*, though there can be little doubt that, if properly applied, it is capable of doing so.

Chemical action in a voltaic battery can be made to produce motion, heat, light, electricity, electrical charges and magnetism, and to overcome other chemical affinity.

Capillary action has been employed to produce electricity, and mechanical effects, etc., but we need not go through the whole category.

In these experimental results, then, consist what is called the correlation of the physical forces—i.e., the transmutability of one of the latter into another or others. The idea is old, but the proofs of its truth have only become numerous within the last half-century. Grove has published an excellent treatise with the above title; to this we refer the curious reader for further detail on this interesting subject.

Conservation of Energy.—But a far more important principle, being, in fact, the *precise* statement of the preceding—which is somewhat vague—is that of the conservation of energy. It is simply the extension (to all physics) of the principle which we have given in full, and proved in a particular case, at the beginning of this article—i.e., that the sum of the potential and kinetic energies of any set of moving bodies cannot be altered by their mutual action. Let us now suppose heat, light, etc., to consist in the energy of vibratory movements of particles, and in their relative states of distortion, etc., and make the supposition that these particles act on each other—no matter by what means—in the line joining each two, and with forces which depend on their distance, and we have at once the theorem, that the sum of the potential and kinetic energies is a quantity unalterable in any system, save by external influences. Hence, when mechanical power is said to be lost, as it is by the unavoidable friction in machinery, etc., it is really only changed to a new form of energy—in general, heat. Thus, when a savage lights his fire, he expends animal energy in rubbing two pieces of dry wood together. If these pieces of wood were not in contact, no force would be required to move them past each other—more and more is required as they are more strongly pressed together. The equivalent of the energy so expended is found in the heat produced. Davy showed that two pieces of ice might be melted by rubbing them together. A skillful smith can heat a mass of iron to redness by mere hammering. Here the energy actually employed is partly given out in the shape of heat, and partly stored up in the iron as potential energy due to the compression of the mass, or the forcible approximation of its particles. Amongst the earliest, and certainly the *best* experiments on this subject, are those of Joule (q.v.). He determined the relation between the units of heat and potential energy of gravitation, by various methods, which gave very nearly coincident results. One of these we may mention. A paddle-wheel is so fixed as to revolve in a closed vessel full of water. The wheel is driven by the descent of a known weight through a measured space, and precautions are taken against losses of energy of all kinds. The water agitated by the paddle-wheel comes soon to rest, as we know; but this is due to friction between its particles; and the final result is the heating of the water. The quantity of water, and also the number of degrees by which its temperature is raised, being measured, a simple proportion enables us to find how many foot-pounds (see FOOT-POUND) of mechanical energy correspond to the raising by one degree the temperature of a pound of water. The result is, that the heating a pound of water one degree Fahrenheit is effected by 772 foot-pounds—and this number is called Joule's equivalent. In other words, if a pound of water fall to the ground through 772 ft., and be then suddenly arrested, its temperature will be raised one degree; and, conversely, the heat that would raise the temperatrure of a pound of water one degree would, if applied by a steam-engine or otherwise, raise 772 pounds one ft. high. Now (see the article HEAT), we know the amount of heat which is produced by the burning (in air) of any material whose composition is known. It follows, then, that from the mere quantity and composition of a substance, we can tell the amount of mechanical work due to its combustion; that is, supposing it all to be effective. As we have been led to the mention of heat of combustion, let us consider what this is due to. Combustion (in air) is merely a chemi-

cal combination of the constituents of the burning body with oxygen—the heat and light which are developed are therefore, by the conservation of energy, equivalent to the excess of potential energy of the uncombined, over the combined, oxygen and combustible.

That this is the real state of the case—and that the original setting fire to the combustible has nothing to do with the matter, as is frequently imagined—will be made evident by considering any spontaneous combination, say that of chlorine and copper filings, or of mercury and sodium, etc., in which cases the potential energy lost by the compound appears as heat, light, and sometimes sound.

The equivalents of the other forms of energy have not been even approximated to, with the exception of that of light. Thomson has determined the energy of a cubic m. of sunlight at the earth to be somewhere about 12,000 *foot-pounds*, giving about 10,000 as the *horse-power* (q.v.) of each sq. ft. of the sun's surface. There are some additional difficulties in the way when we seek the equivalent of electric energy, for here the question arises: "Is there a special substance which is, or the energy of whose motions is, electricity, or does it depend upon motions and distortions of the luminiferous ether?" for we can scarcely suppose it to be due to motions of the particles of *matter*. If the first, we have as yet no means of estimating its energy; if the latter, we may consider it as within the reach of experiment. It may merely be remarked here, that Weber's exquisite theoretical statement of electric laws—resting on the fundamental assumption that there are two *electric fluids*—requires the admission of mutual forces, which vary with the relative velocity of its particles, and for which, therefore, the conservation of energy does *not* necessarily hold.

Helmholtz, in an admirable paper (*Ueber die Erhaltung der Kraft*, translated in Taylor's *Scientific Memoirs*, new series, i.), starting from the assumptions above explained, has applied the principal of conservations of energy to the investigation of many recondite problems connected with the physical energies. We cannot, of course, enter into his work in detail, as it is somewhat analytical, but we may freely borrow such of its contents as we have not already alluded to, at least such as will suit the plan of this article.

A very good example of the conservation of energy is found in the increasing velocity of a planet or comet as it approaches the sun, and thus loses potential energy; and also in the fact, that in the case of these bodies the mere distance from the sun, and the velocity at that distance, enable us to tell at once the nature of the orbit described—i.e., which of the conic sections it is.

Latent heat is probably a form of potential energy, depending on the physical state of the substance in which it is stored up. The same may be said of those substances which, when mixed, produce heat or cold, as water and sulphuric acid, or nitrate of ammonia. It is easily seen that here the heat or cold depends upon a change of molecular arrangement of some kind; that is, a change of the potential energy.

In magnetism and statical electricity, of course, the conservation of energy holds, as we know that all the phenomena can be explained by attractions and repulsions, following the law of gravitation. In the discharge of a Leyden battery, the potential energy lost is reproduced as heat in the connecting wires, and as light, heat, and sound with the disruptive spark. In charging a Leyden jar by means of the electrophorus, the charge is directly produced by the expenditure of mechanical work in overcoming the attraction of the negative electricity of the resinous plate for the positive electricity of the cover.

In the ordinary voltaic battery, the excess of loss of potential energy in the cells by the chemical union, say of zinc and oxygen, and of sulphuric acid and oxide of zinc, over that gained by the decomposition of water, produces the kinetic energy of the current, which may be transformed into heat, light, magnetism, or motion, or two or more. Or it may be employed to reproduce potential energy by chemical decomposition, say that of water. This again, by a spark, can be reconverted into kinetic energy as an explosion accompanied by heat, light, and sound. While an electric current causes the motion of a magnetized needle, our general principle should lead us to infer that the current itself will be weakened. This is found to be the case, but, as it should be, *only during the motion* of the needle. The needle in a permanent state of deflection produces no effect whatever. Now, the diminution of an electric current is simply equivalent to the addition of a weaker current passing in the opposite direction. We should expect, then, that the motion of a magnet near a conducting wire will in general produce a current in the latter, and this is, in fact, Faraday's great discovery of magneto-electric induction. In this case, the current ceases so soon as the magnet ceases to move relatively to the wire.

If a mass of copper or other good conductor be set in rapid rotation near a powerful magnet, the motion produces electric currents in the copper, which, being attracted by the magnet, soon bring the mass to rest. It is not so clear in this case into *what* the mechanical energy of the rotation has been transformed, especially as the electric currents cease with the motion; but if we keep up the rotation forcibly, we find in a short time the copper growing warm; in other words, the energy has been transformed into electric currents, and the latter into heat. This very beautiful experiment is due to Joule, and has been repeated in a striking popular form by Foucault.

Advantage has been taken by Faraday of the phenomena of induction, to produce

electric currents by aid of the earth's magnetism. His apparatus is simply a revolving disk of metal, and the terminal wires touch, one its axis, the other its edge. The energy which is here transformed into electric currents is the additional effort requisite to turn a *conducting* disk, instead of an equal *non-conducting* one. It is a curious consequence that in all metallic machinery a portion of the energy of the prime mover is lost in producing electric currents, and finally heat, in the moving parts, so that heat in such cases is not entirely, though very nearly, due to friction alone.

Perhaps one of the most singular of these transformations of energy is that already referred to of heat into electric energy. Certain crystals, such as tourmaline, become electrified by heat; but electric *currents* can be produced by simply heating a *junction* of two wires or bars of different metals, the other ends also being in contact. Now, if we were to heat the other junction, it is obvious that, as at it the metals are arranged in the opposite order, we should produce a contrary current; conversely, by cooling them we should strengthen the first. But the conservation of energy requires that such a junction should be heated or cooled according to the direction in which a current passes through it. This was discovered by Peltier.

Animal energy is simply a transformation of the potential energy of food. This is well illustrated by the increased diet which is required when man or beast abruptly changes from a state of inactivity to one of toil, as with a polar bear after his winter's sleep; or by the greater amount and better quality of food which are necessary for criminals subject to hard labor, than for those who are merely imprisoned.

Since, then, as far as we have yet seen, there is no such thing as gain or loss of energy anywhere, while it appears that the ultimate transformation of such energy is heat, and that the latter tends to a uniform diffusion or dissipation, in which it is unavailable, as far as we know, for further transformation (see HEAT), whence do we procure the supplies of energy which are requisite to maintain the economy of life? We answer: Chiefly, or indeed entirely, from the sun, whence they come as light and radiant heat, perhaps in other forms. Without the sun, where would be vegetation?—without the latter, where animal life? Where would be our stores of fuel, whether wood or coal? It is entirely then, we may say, to the directly supplied energy of the sun that we look for the maintenance of life; and this leads to a question not of much importance to ourselves, to be sure, but of vast future consequence to the human race: Is this supply finite? Will the sun in time have given off all its energy, or is it continually receiving accessions itself, and if so, has it an inexhaustible store to draw from.

Now, whether the sun be a hot mass, or be surrounded by an atmosphere in an intense state of combustion, or whether it derives the main part of its heat, as Thomson supposes, from gravitation (in a way presently to be considered), it is certain that, as far as we know, it must at some period be exhausted. Such is the apparently inevitable verdict of the conservation of energy.

The gravitation theory of the origin of energy generally may be given in some such form as this: The matter in the universe, in a state of coarser or finer division, originally filled all space, and possessed, therefore, by virtue of gravitation, a certain amount of potential energy. As particles gradually moved up to each other, and became slowly agglomerated into masses, more and more of this energy was realized in its kinetic form; some as heat (that of the sun, or the internal heat of the earth, etc.), some as vis-viva of axial or orbital rotation, etc. There still remains unagglomerated in space (see ZODIACAL LIGHT, AEROLITES, COMETS, NEBULÆ) much of this original matter still falling mainly towards the larger masses, as the sun and stars, and exchanging its potential for kinetic energy. But the latter, as we have seen, tends ultimately to become heat, and to seek a uniform diffusion. This, then, it appears, is to be the last scene of the great mystery of the universe—chaos and darkness as "in the beginning."

An immediate consequence of the truth of the conservation of energy is the impossibility of what is usually understood by the perpetual motion (q.v.); for it is to be carefully remembered that perpetual motion, in the literal sense of the words, is not only possible, but very general. If there were no such thing as friction, or if we had a perfectly smooth body, in the form of a teetotum, for example, it would spin forever in vacuo with undiminished speed. The earth in its axial rotation affords a good example. Were it a perfect sphere, and of uniform material, the other masses of the system could produce no effect whatever on its rotation, and the latter would remain forever unchanged. And even, as we have already seen, when one form of kinetic energy, as electricity, or ordinary vis-viva, is lost, we find it reappearing in other forms of kinetic energy, such as heat and light. But this is not the technical acceptation of the term, the perpetual motion; it is popularly understood to mean a source of motion which will not only preserve its own vis-viva unchanged, but also *do work*. This is, of course, incompatible with the conservation of energy, for wherever work is done, equivalent energy in some form or other is consumed. The ordinary attempts to obtain "the perpetual motion" which are still being made in thousands by visionaries, are simply absurd, based as they are for the most part on ignorant applications of mechanics. There is absolute impossibility here; and a "perpetual motionist" of the common herd is far more infatuated than a "squarer of the circle;" for the latter's problem *may* be solved, though certainly not by the means usually employed, or in the form usually sought for.

We may now briefly consider the chief theories of the various forms of energy which have been advanced of late times. All of them assume at the outset forces of attraction or repulsion between particles, or else a highly elastic fluid, or rather solid, if we may so call it, in which the particles of matter float, or are imbedded. We have already considered the difficulties attending the latter supposition; but it is the only one which does not refer force back to force, thus apparently leaving the question where it found it. We may dismiss it with the remark, that a fluid or quasi-solid absolutely continuous and alike in every part is difficult to conceive; and it is hard to understand how motion can be propagated through it. If it be not continuous, forces must be supposed to be exerted by its parts on each other, else the motion of one part would not affect the others. There is one way in which the latter difficulty has been attacked, which seems plausible enough; and that is, that the particles of this fluid are in a state of rapid motion, and continually impinging on each other and on the particles of matter, no forces being exerted except those of pressure at the impact. This is the notion of Le Sage. But, unless these particles be supposed *elastic*, their motion would be lessened at every impact, and destroyed completely if the impact were direct. This objection seems to be a very strong one. The first-mentioned theory, that of Epinus and Mosotti, assumes that material particles float in a general atmosphere of ether, that the particles of each repel one another, but that a particle of matter attracts one of ether. From these suppositions, and an hypothetical law connecting pressure with density in such an ether, Mosotti has deduced gravitation and the molecular forces; but to apply the hypothesis to the other physical energies, other suppositions are necessary. These have been supplied by Clausius and Redtenbacher, who, with the assumptions of particles of matter and of ether as before, imagine those of matter to attract each other, and also those of ether, but the latter to be mutually repulsive. Light and radiant heat, according to this theory, are vibrations of the ether which fills all space between the particles of matter, or rather, between the atmospheres of ether which, by the foregoing assumptions, the particles of matter will collect about them. Heat consists of vibrations of the molecules of matter, or of the groups of atoms (see ATOMIC THEORY) of which the molecule of a compound body is built up, together with their atmospheres. Electricity, magnetism, etc., are explained to be rotations in the atmospheres. Redtenbacher and Clausius are not quite agreed as to the physical energies corresponding to each of these forms of motion, but the above sketch will give a general idea of the nature of their speculations.

But the most startling of all the reflections on force, and its ultimate nature, which have perhaps ever been made, are those of Faraday. Without calling in question in ordinary cases the truth of the conservation of energy, he has endeavored, by experiment (the only genuine test in a question so novel and so profound), to prove what may be called the conservation of force. Here we understand *force itself*, and *not energy*. He argues thus: Two masses, according to the undisputed law of gravitation, attract with four times their mutual force if their distance be diminished to half; and with only one fourth of the same, if their distance be doubled. He asks *whence* comes the additional force in the former, and *what becomes of* the lost force in the latter case?

Now, it is evident that this is a new question, totally distinct from any we have yet considered. To answer it, we must know *what* force is. Would gravitation have any existence if there were but one particle of matter in the universe, or does it suddenly come into existence when a second particle appears? Is it an attribute of matter, or is it due to something between the particles of matter? Faraday has tried several experiments of an exceedingly delicate kind, in order to get at some answer to his question. A slight sketch of one of them must suffice. A pound-weight is not so heavy at the ceiling of a room as it is when on the floor; for, in the former case, it is more distant from the mass of the earth than in the latter. The difference for a height of 30 ft. is (roughly) about $\frac{1}{350,000}$th of a pound. Now, if a mass of metal be dropped through such a space, an additional force, $\frac{1}{350,000}$th of its weight, is called into play, and the object of the experiment was to detect whether electrical effects accompanied this apparent *creation* of force. The mass, therefore, was a long copper wire, whose coils were insulated (see ELECTRICITY) from each other, and whose extremities were connected with those of the coil of a delicate galvanometer (q.v.). Had any trace of an electric current been produced, the needle of the galvanometer would have been deflected, but, when all disturbing causes were avoided, no such deflection was detected. Other experiments with a view to the detection of other physical energies, were also tried, but, like the first, with negative results only.

We must not hastily conclude that there is such a *thing* as force, though we are in the constant habit of speaking about it. Our sensations are all more or less misleading until we can interpret them. The pain produced by a blow is quite a different thing from the energy of motion of a cudgel; and when our muscular sense impresses on us the idea that we are exerting force, we must be cautious in our conclusions. For it is certain that force is *merely the rate per unit of length* at which energy is transferred or transformed.

There are, in mechanics, several other quantities which retain a fixed value under certain circumstances. We may briefly consider a few of them.

Conservation of Areas. Invariable Plane.—We have seen (CENTRAL FORCES) that if

a particle move about a center of force, its motion is confined to a plane, and its radius vector traces out equal areas in equal times. Similar theorems hold in any system of particles acted on only by their mutual attractions. If in such a system we suppose the positions of the respective particles to be continually projected (orthogonally, see PROJECTION) on *any* fixed plane, and radii vectores to be drawn from *any* point in that plane to the projections—*the sum of the areas swept out by all those radii vectores will be equal in equal times.* Also, this being true of all planes, there is one for which this sum is a maximum, and *this plane is fixed in space.* It is thence called the invariable plane of the system. Similar propositions hold for a system of bodies each of finite size, their several axial rotations being taken into account; hence what is called the invariable plane (q.v.) of the solar system.

Conservation of Momentum.—When two masses attract or impinge, the forces they exert on each other are evidently equal and opposite. Now, the measure of a force is the momentum it produces; hence equal and opposite momenta, in addition to their original quantities, will be communicated to the masses, and therefore the sum of the momenta of the two, resolved in any direction, will be unaltered; hence, *the sum of the momenta of any number of bodies will be unaltered by mutual actions either of the nature of attraction or impact.*

Conservation of the Motion of the Center of Gravity.—Again, in such a system, the momentum of the whole collected at its center of inertia, resolved in any assigned direction, is the sum of the momenta of the separate bodies in that direction; hence, *the center of inertia of a system, subject to none but the mutual actions of its components, either remains at rest, or moves uniformly in a straight line.*

For a simple, and as far as possible non-technical, discussion of the subjects so briefly noticed above, the reader may be referred to Tait's *Recent Advances in Physical Science* (second edition).

FORCE, PETER, 1790–1868; b. N. J. He was a printer in New York, and afterwards in Washington, where he started a statistical annual, *The National Calendar*, continuing it for 16 years. During the presidency of John Quincy Adams he published the *National Journal*, the first to be stigmatized with the title of "official organ." He was mayor of Washington and president of the national institute for the promotion of science. His great work was the compilation of the *American Archives*, consisting of 9 folio volumes, published by the government. In this work, he was employed for 30 years. The collection was purchased for the congressional library. He published also historical tracts relating to the early history of the colonies.

FORCE AND FEAR. As consent is of the essence, or rather is the essence of all contracts, and as consent implies not only intelligence, but unfettered power of action in the consenting parties, contracts, by the laws of all civilized nations, will be invalidated if it shall be proved that they were entered into under the influence of force or fear. Circumstances which constrain the will have the same effect as those which blind the understanding, and the law of force and fear is consequently closely analogous to that of fraud (q.v.), including under that head misrepresentation, concealment, and consequent error (q.v.). But it is not every degree of constraint, however exercised, which will have this effect in law. On the contrary, it must be of such a description as may be reasonably supposed to influence the will of the party in the circumstances in which he is placed at the time. In determining, therefore, whether there really has been force or fear in the legal sense, the law will take into account the age, sex, education, and other personal characteristics of the party, along with the accidental circumstances in which he was placed, e.g., the state of his health and spirits at the time, whether he was alone, what anxiety he may have felt for the life or interest of others, and the like. But "where there is no peculiar weakness of age or sex, or condition," says Mr. Bell, stating in this respect not the law of Scotland alone, but of most other countries, "law will require, in order to annul a contract, such fear and compulsion as may reasonably shake a mind of ordinary constancy and resolution, and will not listen to the pretense of every vain and foolish fear."—*Com.* i. p. 22, Shaw's ed. As a contract which is invalid on the ground of force and fear is not only incapable of being enforced after its invalidity has been ascertained by legal process, but from the absence of consent was invalid *ab initio*—i.e., no contract, in a legal sense, at all—the object of the law is to restore the parties to the position in which they were before it was entered into. All moneys which have been paid under the provisions of the extorted contract must consequently be repaid, and reparation in as far as possible must be made by the payment of damages for such personal injuries as the party who was dragged into it may have suffered from the enforcement of its provisions. See REDUCTION. By the law of England, duress (q.v.) which will invalidate a contract must amount to fear of the loss of life or limb called mayhem. "Whatever is done by a man to save either life or member," says Blackstone, "is looked upon as done upon the highest necessity and compulsion. Therefore, if a man, through fear of death or mayhem, is prevailed upon to execute a deed, or do any other legal act, these, though accompanied with all other the requisite solemnities, may be afterwards avoided." But "a fear of battery or being beaten, though never so well grounded, is no duress; neither is the fear of having one's house burned, or one's goods taken away and destroyed, because in these cases, should

the threat be performed, a man may have satisfaction by recovering equivalent damages."—Stephen's *Com.* i. p. 142. The avoidance of such a contract is, however, dependent on the will of the injured party. "A contract made under duress may be avoided by the person whose free-will was thus restrained, though he has also an election, if he thinks proper, to insist upon it as a binding transaction" (*Ib.* vol. ii. p. 62). But the parties who are entitled to treat a contract either as a nullity or a subsisting contract, must make their election, and cannot, after treating the contract as rescinded, set it up as a subsisting contract (Addison on *Contracts*, pp. 273, 436, and 1074).

FORCELLI'NI, Egidio, an Italian philologist of great attainments, was born on the 26th of Aug., 1688, in a village near Padua. Owing to the limited means of his family, F. was deprived of the benefit of early instruction, and was already verging towards manhood when enabled to commence a regular course of study in the seminary at Padua. His zealous industry, combined with unusual powers of learning, singled him out from his companions, and won the admiration of the learned principal, Giacomo Facciolati, who even associated him with some of his own scientific labors. The pupil rendered his teacher valuable service in the compilation of a highly important lexicon, a work which probably inspired both with the project on which F.'s literary repute is based—viz., the compilation of a vast and comprehensive vocabulary of the Latin language. The work was published after F.'s death, and pronounced by public voice as one of the most valuable acquisitions to philological science of the age. In addition to the Italian and Greek signification of the Latin word, the literal and figurative application of each expression is given in a collection of examples, in themselves a perfect compendium of knowledge, embracing the customs, laws, arts, sciences, religion, and history of the Romans. This immense work was published in 4 vols., folio, under the title, *Totius Latinitatis Lexicon, consilio et cura Jac. Facciolati, opera et studio Aeg. Forcellini Lucubratum* (Padua, 1771). Furlanetto's appendix appeared in 1816 (Padua), and a new edition of the complete work was published in 1828 (Padua). F. died in 1768.

FORCENÉ, said, in heraldry, of a horse when rearing, or standing on his hinder legs.

FORCEPS (Lat. a pair of tongs or pincers), the name given by surgeons to an instrument of great antiquity, used as a substitute for the fingers, and consisting of two levers of metal jointed together crosswise, nearer to one end than the other. The hand grasping the longer ends of the levers or handles, closes the shorter ends, which are shaped so as to seize firmly the intended object. There is scarcely a surgical operation in which it is not applied; and it is made of various forms, to suit different cases. In addition to the forms used in dentistry (q.v.), there is, e.g., the *dissecting* forceps, which has roughened points, to lay hold of small portions of tissue which are to be divided by the knife; the *lithotomy* forceps, again, has blades concave like spoons; and *fenestrated* forceps have apertures in the blades, and as the soft tissues project into these, a firm hold is obtained with less risk of tearing the parts. By means of Liston's *cutting* forceps, a powerful hand can divide a great thickness of bone. But the most important of all is the *midwifery* forceps, an invaluable invention, in cases of difficult delivery, which daily rescues from suffering and danger numerous mothers and infants. It was gradually brought to its present perfection; but the name of Chamberlen, an accoucheur of the time of James II., is associated with it, as one of its chief improvers. It consists of two concave fenestrated blades, forming a cavity into which the head of the child fits. The blades are applied separately, one to each side of the head, and then locked together. Holding by the handles, the accoucheur aids the natural efforts of labor. The instrument does not necessarily or generally injure either mother or child.

FORCHHAMMER, Johann Georg, 1794–1865; b. Prussia; studied at Kiel and Copenhagen, and was with Oersted and Esmarch in a mineralogical exploration of Bornholm. He was lecturer in the university of Copenhagen on chemistry and mineralogy in 1828, occupied the same position in the polytechnic school in 1829, and in 1831 became professor of mineralogy in the university and curator of the geological museum. He succeeded Oersted in 1851 as director of the polytechnic school and secretary of the academy of sciences.

FORCHHEIM, a fortified t. of Bavaria, circle of Upper Franconia, near the junction of the Weisent with the Regnitz, 16 m. s.s.e. of Bamberg. It has a castle, a collegiate and two other churches, a synagogue, a monastery, and a hospital. Its industries include brewing, tanning, soap-boiling, and glass manufacture. Forchheim is of very early origin. Charlemagne transplanted thither, in 804, a number of Saxons from the Elbe, and made it an important commercial entrepôt. In the 9th and 10th centuries, many assemblies, both of the princes and the kingdom, were held at Forchheim, and, in 890, a council of the church. In 1700, it was presented by the emperor Henry II. to the newly founded bishopric of Bamberg, but in 1040, Henry III. united it again to the kingdom. Henry IV., however, again presented it to the bishopric of Bamberg, with which it remained till 1802, when it came into the possession of Bavaria. In 1552, it was captured by the margrave Albert Brandenburg, and in 1634, besieged by Bernhard of Weimar. Its fortifications were restored in 1791. Aug. 6 and 7, 1796, a battle took place in its vicinity between the French and Austrians, in which the French held possession of the field. Forchheim ceased to occupy the position of a fortified town after 1838. Pop. '75, 3,847.

FORCIBLE ENTRY consists in taking or keeping possession of real property through threats or force, with no authority of law. To make such entry forcible, there must be such acts of violence, menaces, or gestures, as may give reason to suspect personal injury or danger in making a defense. But the force must be more than is implied in mere trespass. There are in most of the states statutes regulating proceedings in cases of forcible entry, directing the manner of proceeding for the restoration of property and the punishment of the offender. The plea of ownership is not satisfaction for the defendant, for no one may enter even upon his own property in any other than a peaceable manner. Nor can he be excused on the plea that he entered to enforce a lawful claim or make a distress, nor on the plea that possession was finally obtained by entreaty.

FORCING, in gardening, is the artificial application of heat to accelerate vegetation. The term is not usually applied to the cultivation of exotic plants in hot-houses, where the object is to imitate as much as possible their native climate; but it is strictly applicable to the system usually pursued with vines and pine-apples, to secure the production of fruit at desired seasons, and by different plants of the same kind in succession through a considerable period, the heat being increased for one set of plants sooner than for another. Many of the fruits and vegetables which grow well in the open air, are very commonly *forced*, in order that they may be procured at seasons when they could not without artificial means. Thus, sea-kale and rhubarb are forced by means of the heat produced by heaps of fermenting litter, by which at the same time they are blanched, and to this we owe their appearance in the market very early in the season. Potatoes, pease, kidney-beans, asparagus, salads, etc., are often forced by means of hot-beds, or in flued pits; or a place is found for them in hot-houses. Strawberries are cultivated in pots, and forced in hot-houses; and some kinds of fruit-trees are often treated in the same way, particularly cherries; and very diminutive trees may be seen richly loaded with fruit. Certain varieties are regarded by gardeners as particularly suitable for forcing. The system pursued in the orchard-house (q.v.) cannot be called forcing.

FORD, a co. in n.e. Illinois, on the upper streams of Vermilion river, intersected by the Illinois Central and the Wabash railroads; 450 sq.m.; pop. '70, 9,103. The surface is mostly prairie, and the soil is fertile, producing corn, wheat, etc. Co. seat, Paxton.

FORD, a co. in s.w. Kansas, intersected by the Atchison, Topeka, and Sante Fe railroad; 1080 sq.m.; pop. 2,160. It is an agricultural region. Co. seat, Dodge City.

FORD, JOHN, an English dramatist, was the second son of Thomas Ford of Ilsington, in the co. of Devon. The date of his birth is not known, but he was baptized in Ilsington church, 17th of April, 1586. His family was connected with the famous lord chief-justice Popham, and he became a member of the middle Temple in Nov., 1602, his cousin, a John Ford also, at the same period being a member of Gray's inn. Unlike many members of the poetic tribe, F. seems to have adhered to his studies, and to have attained some professional success. His first poem was an elegy on the death of the earl of Devonshire, entitled *Fame's Memorial*, and subsequently he assisted in the composition of various plays; perhaps, from his conjunction with Webster and Decker, in this way he acquired, or at least whetted, his appetite for tragic horrors. In 1629, he produced *The Lover's Melancholy;* and four years after, *The Broken Heart*, and *Love's Sacrifice*. Next year came *Perkin Warbeck;* and in 1638-39, *The Fancies Chaste and Noble*, and *The Lady's Trial*. After this, F. drops out of literary history. Some think that he died soon after; others, that he retired to his native place, married, and lived to an old age, with sons and daughters growing up around him.

F. takes a high position as a dramatist, and this position he attains more by general mental force than by dramatic instinct, or by what we are accustomed to call poetic genius. In his compositions, there is a sense of effort; his writing looks like task work; and one can hardly suppose that he enjoyed his work. His versification—even when the subject matter is distinctly noble—is hard and prosaic. He has no humor. He has been praised for his pathos, but in his pathetic scenes effort is apparent. He cannot "flatter" you to tears, as Shakespeare and the greater poets do. An edition of his works, published by Moxon (Lond. 1840), is enriched by biographical and critical notices by Hartley Coleridge; another, by the Rev. Alex. Dyce, appeared in 1869.

FORD, RICHARD, 1796–1858; b. England; author of one of the earliest and best of travelers' handbooks. He was educated for the law, but never practiced. He traveled in Spain and other parts of Europe, and began his literary career by contributions to the *Quarterly Review*. Among his more important works are *The Policy of England towards Spain*, and *Handbook for Travelers in Spain*.

FORD, THOMAS, an English musician attached to the court of prince Henry, the son of James I. His works consist of canons and other concerted pieces of vocal music, chiefly with lute accompaniments. The principal collection of his works is *Musike of Sundrie Kinds set forth in Two Books*, etc.

FORD—FORDING. When a river or rivulet is crossed without the aid of either a bridge or ferry, it is said to be forded, and an established place for this crossing is

called a ford. Thus, we have Oxford, Stratford, Deptford, Hungerford, etc., towns built around ancient fords. To the military engineer and the traveler in wild countries, the selection of the safest place for fording a river is a matter of some practical importance. In the first place, the *widest* part of the river should be chosen, as, wherever a certain quantity of water is flowing, the wider its bed—the rapidity of the flow being the same—the shallower it must be. At the bend of a river, the line of shallow water does not run straight across, but extends from a promontory on one side to the nearest promontory on the other. The stream usually runs deep along hollow curves, and beneath steep perpendicular and overhanging banks, whilst it is always shoal in front of promontories, unless the promontory is formed by a jutting rock. For safe fording on foot, the depth of water should not exceed 3 ft.; on horseback, 4 ft.; or a foot less for each, if the current be very strong. The bottom of a ford should be firm and even; weeds, blocks of stone, etc., are serious obstacles, especially for cattle. When a caravan, a number of troops, or of cattle, have to cross, a sandy bottom is very bad, for the sand is stirred up and carried away by the stream, and renders the ford impracticable for the hindmost. For a small party, hard sand or gravel is the safest bottom.

The inhabitants of a district generally know the safest fords, and their experience affords a better guide than the best rules that can be given. Fords are continually varying, either from the swelling of the river or the shifting of its bed or banks, and therefore it does not follow that the place set down by one traveler as a safe ford, will continue so for the next that succeeds him.

FORDHAM, now a part of the city of New York, but formerly a village in Westchester county. It is noted as the seat of St. John's college, an institution under the charge of the Jesuits, built on 20 acres of land, and comprising several buildings. The college has 10 professors, 77 undergraduates, and 150 students. Besides this institution, there are in the vicinity the St. Joseph theological seminary and St. Mary's church. Near by are the considerable estates of the Lorillards with their factories, the Jerome skating-pond, and Jerome park, one of the finest race-courses in the country, managed by the American jockey club. Pop. 2,000.

FORDUN, JOHN OF. Nothing more is certainly known of this early Scottish chronicler, than that he was a secular priest, and wrote about the year 1380. It has been inferred from his name that he was born at Fordun, in Kincardineshire, and it has been said that he was a canon of the cathedral church of Aberdeen. Having proposed to himself the compilation of a chronicle of Scotland, he is said to have traveled on foot through Britain and Ireland in search of materials. He lived to write only five books of his *Scotichronicon*, bringing the history down to the death of king David I. in 1153. He left collections extending to the year 1385, about which time he is supposed to have died. The work which John of F. had left unfinished was resumed in the year 1441 by Walter Bower, abbot of the monastery of Austin canons regular, at Inch Colm, or St. Colm's Inch, in the firth of Forth. He enlarged the five books which F. had completed, and making use of his collections so far as they went, wrote 11 new books, bringing the *Scotichronicon* down to the year 1437; but he also made many arbitrary alterations which present things in quite a different light from F.'s narrative. The work is the chief authority for the history of Scotland prior to the 15th c.; its value being greatest during the 14th, when it is contemporary. It exists in upwards of 20 MSS., the principal of which is preserved in the Wolfenbüttel library. Four printed editions have been published, but the best is that edited by W. F. Skene (2 vols., Edinburgh, 1871–72), from the text of the Wolfenbüttel and other standard MSS. Bower's interpolations and additions are separated from F.'s text.

FORE (i.e., first), a term applied to the front or foremost part of a ship. The *fore-hold* is that part of the hold intervening between the cutwater and the foremast. The *forecastle* is that portion of the upper deck extending from the foremast to the bow; it is the part to which the common sailors have free access, and probably derives its name from a small turret or castle placed near the prow in ancient vessels, from which darts and other projectiles could be most conveniently hurled upon an enemy. *Foremast* is the first of the three masts, or of the two, when only that number are present. It is surmounted by the foretop-mast, foretop-gallant-mast, and fore-royal; its sails being foresail, foretop-sail, etc.; between it and the bow flies the fore-staysail, hoisted on the forestay, a massive rope passing from the foretop to the bow, and, with the backstays and shrouds, maintaining the mast in a perpendicular position. The *fore-braces* are ropes passing from the extremities of the foreyard into the maintop, whence they descend through pulleys to the deck, where they serve, when necessary, to alter the direction presented by the foresail to the wind.

FORECLOSURE, in English law, the process by which a mortgagor failing to repay the money lent on the security of an estate, is compelled to forfeit his right to redeem the estate. Every person having mortgaged his estate, is entitled to an equity of redemption, which can only be cut off by a formal process. For this purpose, the mortgagee files a bill of F., praying that an account may be taken of the principal and interest due under the mortgage, and that the mortgagor, on failing to pay, may forfeit his equity of redemption. If on the day fixed for payment, the money be not forth-

coming, the mortgagor will be declared to have forfeited his equity of redemption, and the mortgagee will be allowed to retain the estate in perpetuity. See MORTGAGE.

FOREHAND RENT. In Scotch law, rent is said to be forehand when it is made payable before the crop, of which it is the rent, has been reaped. After the period when it is due and eligible, F. R. is *in bonis* of the lessor, and passes to his executor, not his heirs (Bell's *Law Dictionary*).

FOREIGN ATTACHMENT may have reference either to person or property. A defendant who has been arrested or attached in a foreign country, may be again arrested in England on the same ground of action. Thus, where a defendant had been arrested abroad on an English judgment, and escaped and came to England, the court of queen's bench decided that he may be holden to bail in an action on the judgment. But after an arrest in Ireland or Scotland, the defendant cannot, in general, be again arrested in England for the same debt, neither of these countries being deemed foreign to that effect (Wharton's *Dic.*). Under the same name, a proceeding for securing the debts due to the defendant has been immemorially used in the cities of London and Bristol (Stephen's *Com.* iii. p. 663, *note*); and by the C. L. P. act of 1854, a similar proceeding has been adopted, but with this difference, that whereas by a F. A. in the lord mayor's courts, debts are attached for the purpose of compelling the defendant to appear and put in bail to the action, no such proceeding can take place in the common-law courts till after judgment. See GARNISHMENT. In Scotland, where a creditor may both incarcerate a debtor and attach his effects, an English creditor may attach the property of his debtor, though he has imprisoned him in England. See ATTACHMENT, APPREHEND, ARREST, FOREIGN COURTS. The corresponding phrase in Scotland is *arrestment*, which has reference both to person and goods, and is a proceeding at common law applicable to the whole country. As to the validity of a Scotch arrestment *ad fundandam jurisdictionem*, to enable the Scotch courts to proceed against a foreigner though absent, see the recent appeal case of the London and North Western Railway co. *v.* Lindsay, Macqueen, iii. p. 99.

FOREIGN ATTACHMENT (*ante*). In several of the states of the American union the statutes provide for action similar to foreign attachment, and authorize the levy upon property of absent, non-resident, and absconding debtors. But the laws vary, and a case can best be understood after consulting the enactments.

FOREIGN AUXILIARIES. In the early periods of English history, F. A. were by no means uncommon. Harold had a body of Danes in his army when he defeated the Norwegian king; and to their refusal to march against the kindred Normans he owed not the least among the complications which ultimately overwhelmed him. Passing to modern times, William III. had for some time a body of Dutch troops in his pay as king of England: throughout the 18 c., Hessian and Hanoverian regiments were constantly in the pay of the English government for temporary purposes. Hessians fought for us in the first American war; and the landgrave of Hesse, who sold his troops at so much a head, received upwards of half a million for soldiers lost in the campaign. During the Irish rebellion, again, in 1798, many Hessian troops were employed.

On the outbreak of the continental war in 1793, it was determined to recruit the British army by the addition of a large body of foreigners; and accordingly, in 1794, an act passed for the embodiment of the "king's German legion," consisting of 15,000 men. These troops, who were increased in the course of the war to nearly double that number, distinguished themselves in various engagements, and formed some of the regiments on which our generals could best rely. Corps of French *émigrés*, as the York rangers and others, were also organized. The whole of the foreign legions were disbanded in 1815, the officers being placed on half-pay.

During the Russian war, in 1854, the British government again had recourse to the enlistment of foreigners; special provision being made in the act authorizing their employment, that the arms of the legionaries were in no case to be used against British subjects, in the event of internal discord. The numbers to be raised were 10,000 Germans, 5,000 Swiss, and 5,000 Italians; the pay to be the same as to British troops, but temporary service to convey no claim to half-pay. About half the number of men were enrolled, and were said to have reached great efficiency, when the stoppage of hostilities arrested their progress, and caused them to be disbanded at a great cost for gratuities, etc.

The Swiss auxiliaries used to form a regular contingent in many of the armies of Europe, especially of France and Italy. Over 1,000,000 served in France from the time of Louis XI. to that of Louis XIV. (1465-1715). See GARDES SUISSES. The Swiss usually served only on condition of being commanded by their own officers, and occasionally these officers obtained distinction and fame. But the privates returned home poor and often demoralized; and the cantons which supplied most mercenaries suffered severely by their absence. After the French revolution, the cantons ceased publicly to hire out their subjects; and after 1830 most of the cantons forbade foreign enlistment. In 1859, the confederacy passed a severe law against recruitment for service abroad. There is still, however, a large contingent of Swiss as mercenaries in the Dutch East Indian colonies. The papal Swiss troops have shrunk to a body-guard of about 100 men.

FOREIGN BILL OF EXCHANGE is a bill which is either both drawn and accepted abroad; or drawn by a person residing abroad on a person in this country, or the reverse. If a bill be drawn abroad, and accepted in England, it does not require a stamp; but if drawn in this country upon a correspondent abroad, or a foreign house, it must be stamped (19 and 20 Vict. c. 97, ss. 6 and 7); and when drawn abroad, it must be stamped by the holder, before he can present it for payment, or indorse, transfer, or otherwise negotiate it within the United Kingdom (Chitty on *Bills of Exchange*, 72). It has, however, been decided that the stat. 17 and 18 Vict. c. 83, s. 3, does not render a stamp necessary where a bill drawn abroad has been indorsed abroad to a person in England, and presented by him for acceptance in England (Phillimore, *International Law*, iv. 609). Formerly, a bill drawn or payable in Scotland or Ireland, was foreign in England; but such bills were made inland by the statute just mentioned; and the same regulation was extended to the islands of Man, Guernsey, Jersey, Alderney, and Sark (s. 7). See BILL. It has been established as a rule in England, that the liabilities of the drawer, the accepter, and indorser, shall be governed by the laws of the countries in which the drawing, acceptance, and indorsement respectively took place (Phillimore's *International Law*, iv. p. 606 and 506). In the case of bills which are both drawn and accepted abroad, and which are thus in reality foreign contracts, but of which the accepter is a native of this country, and which are sought to be enforced in the courts either of England or Scotland, a distinction is made between the contract and the remedy. "Whatever relates to the nature of the obligation—*ad valorem contractus*—is to be governed by the law of the country where it is made—the *lex loci;* whatever relates to the remedy, by suits to compel performance, or by action for a breach—*ad decisionem litis*—is governed by the *lex fori*—the law of the country to whose courts the application is made for performance or for damages."—Lord Brougham in Don *v.* Lippman, house of lords, 26th May, 1837; Shaw and Maclean, ii. p. 723.

FOREIGN COURTS. Kent, after stating that in cases not governed by the constitution and laws of the United States, the doctrine of the English law, as to the force and effect to be given to foreign judgments, is the law of his own country also, observes that the law thus common to England and America "is exceedingly, if not peculiarly liberal, in the respect which it pays to foreign judgments, in all other cases except the case of a foreign divorce or an English marriage. A distinction was early taken by lord Nottingham, and is now recognized both in England and America, and indeed almost everywhere else, between a suit brought to enforce a foreign judgment and a plea of a foreign judgment in bar of a fresh suit for the same cause. As the effect to be given to a foreign judgment is altogether a matter of comity, in cases where it has not been regulated by positive treaty, and no sovereign is bound to execute within his own dominions a sentence given out of it, the rule adopted, where a suit is brought to enforce a foreign judgment, is that the foreign judgment is to be received, in the first instance, as *primâ facie* evidence of the debt, but that the defendant is entitled to impeach the justice of it, or to show that it was irregularly and unduly obtained. But the case is different where the losing party comes forward and wishes to institute a new suit upon the same matter, and to open up a foreign judgment dismissing the action, pronounced by a competent court. In this case, to interfere with the foreign judgment would be to assume the attitude of a court of review, and the rule in England, consequently, is that such a decision, when given by a foreign court, is final and conclusive. So obvious, indeed, is the convenience and necessity of this rule, that it has been regarded as forming a portion of general jurisprudence."—Kent's *Com.* ii. 101, 102. As regards the enforcement of foreign decrees and judgments, the usages of nations have differed considerably, and the subject is far too wide and too difficult to admit of being satisfactorily discussed in this work. The distinction between the recognition of the judgment of a foreign court, as determining the validity of a foreign contract, and the application of a foreign remedy by the courts of this country, has been pointed out under foreign bill of exchange (q.v.). For practical purposes, however, it may be convenient that we should state that, contrary to the popular belief in England, the French courts are in the habit of giving effect to judgments obtained in England, and that debtors cannot escape from their creditors, as is too generally supposed, by simply crossing the channel. The difficulty, no doubt, still exists where the debtor has escaped before any proceedings could be taken against him in this country, and where no judgment can be obtained. But if he has once been served with process in England, or cited either edictally or otherwise in Scotland, the creditor may go on with his action against him though he be personally absent from the country, and ultimately enforce his decree against him by the interposition of a French court. The same observations apply to Belgium. In England, there is no regular office, as in Scotland, for the publication of citations to persons abroad (see EDICTAL CITATION), but leave to substitute service at the last place of abode, in place of personal service, may now be obtained in some cases from the courts, or leave may be granted to serve out of the jurisdiction. In most countries, the rule as to two foreigners resident but not domiciled is, that they may sue each other in the ordinary courts, as natives do. To this the French courts are an exception, and hold themselves incompetent to entertain suits between undomiciled foreigners relating to personality, except in matters of commerce (Phillimore,

International Law, iv. 645). See JURISDICTION; DOMICILE; INTERNATIONAL LAW, PRIVATE; CONFLICT OF LAWS, etc.

FOREIGN ENLISTMENT ACT. In the law of England, there was a statutory prohibition of enlistment in the service of a foreign prince in 3 Jac. I. c. 4, s. 18; but the statute commonly known as the F. E. A. is 33 and 34 Vict. c. 90. It provides that if any British subject shall agree to enter the service of any foreign state, either as a soldier or a sailor, without the license of her majesty, or an order in council or royal proclamation, or if any person within the British dominions induces any other person to enlist in the service of a foreign state, such person shall be guilty of a misdemeanor. The officers of the customs, on information on oath, may detain any vessel having persons on board destined for unlicensed foreign service. Masters of vessels, knowingly having such persons on board, are punishable by fine or imprisonment, or both. Persons building any vessel for foreign service, without license, are guilty of a high misdemeanor, and the ship and stores are forfeited. Even to assist a foreign state with warlike stores, without license, is a misdemeanor punishable with fine and imprisonment. These penalties are irrespective of any consequences that may follow to the individual for having committed a breach of international law.

FOREIGNER. See ALIEN.

FOREIGN JUDGMENT is the decree of any tribunal outside of the jurisdiction in which it operates. Such judgments depend for their value and enforcement upon agreement between states and nations. The states of the American union are absolute in their several dominions, and are guided by their own laws; but the needs of society and order require a recognition of the rights of other states, and hence we have, as between nations, a recognition of the efficiency of state enactments under certain prescribed formulæ. The constitution provides that "full faith and credit shall be given by each state to the public acts, records, and judicial proceedings of every other state; and that congress may prescribe the manner in which such acts, records, and proceedings shall be proved, and the effect thereof." Under this provision congress enacted the law which says: "The records and judicial proceedings of the courts of any state shall be proved or admitted, in any other court within the United States, by the attestation of the clerk and the seal of the court annexed, if there be a seal, together with the certificate of the judge, chief-justice, or presiding magistrate, as the case may be, that the said attestation is in due form. And the said records and judicial proceedings, authenticated as aforesaid, shall have such faith and credit given to them, in every court within the United States, as they have by law or usage in the courts of the state from whence such records are or shall be taken." This general rule holds good in nearly all cases, except divorce. In that, the opinions are almost as diverse as the laws. The Roman Catholic church, and countries where that is the established religion, deny the right of divorce. English courts hold that no foreign authority can dissolve an English marriage. In the United States, although the statutes differ materially, a divorce granted in good faith, according to law in any state, is recognized in all other states. A few years ago the facility with which divorces could be obtained in one of the western states became so notorious and so much a cause of scandal that the laws of that state were amended in that respect.

FOREIGN LAWS. Such laws have no absolute power beyond the jurisdiction of the government enacting them, except by the comity and good neighborhood of nations or states. In the American union, it is the practice of all states to give credence and regard to the laws of all other states, and in personal causes these laws are enforced by extradition or more generally a writ of requisition. In relation to federal government, the states are not regarded as foreign, but domestic, and when the laws of any one of them are to be examined and applied in the federal tribunals, no proof is necessary. These courts take judicial notice of such laws in the same manner as each state by itself applies its own enactments, without requiring testimony in reference to them as matter of evidence. In like manner, the state courts take judicial notice of the laws of congress.

FOREIGN OFFICE, of Great Britain, was established in 1782 at the re-arrangement of the duties of the secretaries of state. It has charge of British interests in foreign countries. The secretary for foreign affairs negotiates treaties, selects diplomatic officers, and grants passports.

FOREKNOWLEDGE and FORE-ORDINATION. I. Foreknowledge, in theology, is God's absolute knowledge of all things before they come to pass. Such knowledge of anything is impossible to man. The human mind, through the limitations of its nature, fails to comprehend how the foreknowledge of God can be harmonious with the free agency of man. Its efforts to escape the difficulties that it cannot solve have produced various theories, among which are the following: 1. *That God may choose, sometimes, not to exercise his infinite capacity of knowledge*, in like manner as he does not always put forth the full measure of his omnipotence. But to this two answers are given. (1) That choice implies foreknowledge. God must know a thing in order to know whether he chooses not to know it. His knowledge of the thing must be perfect; if there were one point concerning which he was ignorant, that one might contain an element which would render the choice unwise and fatal; or which, if known, would prevent the

choice from being made. (2) Supposing it possible for God to make such a choice, it would not meet the difficulty. Concerning the things that he chose to know, the question would still have to be asked, How can God's foreknowledge of them be consistent with human liberty in doing them? 2. *That foreknowledge of contingent events being impossible* (because it implies a contradiction), *there is no dishonor to God in affirming that of such events he has no foreknowledge.* To this the answers are: (1) If the impossibility here asserted really existed, there could be no foreknowledge whatever; for every event is contingent on something and perhaps on many things. Especially if the impossibility existed with reference to the moral actions of men, would God's moral government over them be impossible. (2) Foreknowledge of contingent events is not impossible to an infinite being, for it requires only knowledge of all things on which the events are contingent. And, on the other hand, certain knowledge concerning a contingent event does not take away its contingent character; for contingency is the opposite not of certainty, but of necessity. God's perfect knowledge of all contingencies may render him perfectly certain that an event will happen without any agency on his part in constraining it to happen. 3. *That since God's foreknowledge differs so much from everything among men to which the same name can be, in part, applied, and consequently from all ideas which they can form of it as belonging to God, argument concerning it must be groundless and controversy fruitless.* To this the answer is, that the conclusion is correct so far as the divine foreknowledge differs in kind from the foreknowledge of men; but if the difference between them be, in part, a difference only of degree, then there may be ground for argument and advantage from discussions wisely carried on. And if the wisdom be shown in excluding from discussion all questions concerning the *mode* in which the foreknowledge of God is consistent with the free agency of men, the full measure of advantage may be gained in clearly establishing the consistency as a *fact*. Beyond this the human mind has never advanced, and it is probably safe to say that it never will. The consequences of denying that the foreknowledge of God extends to all events (however contingent some or all of them may be) have been well shown by president Edwards. "It would follow from this notion (namely, that the Almighty doth not foreknow what will be the result of future contingencies) that as God is liable to be continually repenting what he has done, so he must be exposed to be constantly changing his mind and intentions as to his future conduct, altering his measures, relinquishing his old designs, and forming new schemes and projections. For his purposes, even as to the main parts of his scheme (namely, such as belong to the state of his moral kingdom), must be always liable to be broken through want of foresight, and he must be continually putting his system to rights, as it gets out of order through the contingence of the actions of moral agents: he must be a being who, instead of being absolutely immutable, must necessarily be the subject of infinitely the most numerous acts of repentance and changes of intention of any being whatsoever; for this plain reason, that his vastly extensive charge comprehends an infinitely greater number of those things which are to him contingent and uncertain. In such a situation he must have little else to do but to mend broken links as well as he can, and be rectifying his disjointed frame and disordered movements in the best manner the case will allow. The supreme Lord of all things must needs be under great and miserable disadvantages in governing the world which he has made and has the care of, through his being utterly unable to find out things of chief importance which hereafter shall befall his system, which if he did but know, he might make seasonable provision for. In many cases there may be very great necessity that he should make provision, in the manner of his ordering and disposing things, for some great events which are to happen of vast and extensive influence and endless consequence to the universe, which he may see afterwards, when it is too late, and may wish in vain that he had known beforehand, that he might have ordered his affairs accordingly. And it is in the power of man, on these principles, by his devices, purposes, and actions thus to disappoint God, break his measures, make him continually to change his mind, subject him to vexation, and bring him into confusion."

II. *Fore-ordination* is included in what the Scriptures call the purpose of God with respect to the destiny of men. This in theology is presented as his purpose in eternity to do precisely those things, and only those, which he actually does in time. Since, therefore, it is admitted that all his actions are in accordance with infinite justice, wisdom, and love, it follows that his eternal purpose to perform precisely those actions was also infinitely just, wise, and good. The Scriptures teach that it was God's eternal purpose to create the world precisely as he did create it; to create men holy, yet liable to fall; to permit his fall, in view of all the circumstances attending it and of all the circumstances resulting from it; to provide a Savior suited to the wants of all, and able, as well as willing, to save all—"God so loved the world, that he gave his only-begotten Son, that whosoever believeth in him should not perish, but have everlasting life;" to commit the proclamation of redemption to men with sincerely uttered directions to spread it through all the world and to every creature; to address full and earnest invitations to every man; to give free salvation to every one who accepts these invitations, and to condemn every one who refuses or neglects them—to condemn him for his refusal or neglect, as well as for all his other sins. But all this could not be unless actual provision had been made for all and offered sincerely to all. This is harmonious

with the Savior's own teaching—"This is the will of him that sent me, that every one who seeth the Son and believeth on him may have everlasting life." The eternal purpose of God, therefore, is that all who accept the offer of salvation through the atonement of Christ shall be saved, but that all who finally reject that offer shall be lost. Here, if God had not been an omniscient being, he might have arrested his purpose, thinking that he had made all the provision for the salvation of men that their character and condition required, and that it would certainly be gladly accepted by them. But he knew all that was in man. He foresaw that there would be an unwillingness on their part to accept this offer, and that the unwillingness would be general and universal. If, therefore, his purpose had rested here, the purpose of salvation would have failed. But his eternal purpose went further. God resolved to secure all the saving results from the atonement and mediation of Christ which he could secure consistently with his character and position as moral governor over the actual universe of free intelligences which he had seen it best to create. The development of this purpose may, by the light of Scripture and of facts, be traced, it is maintained, several steps further. God purposed to secure the salvation of a large part of mankind by taking them to himself and renewing their natures before they were able to accept the Savior personally for themselves, and consequently, before they were able to reject him. In this way, it is said, about one half of the race, being in infancy, are saved of every generation, of every country, and every form of religion. In regard to those who are continued in this life to years of accountability, God's purpose, it is maintained, is to secure the salvation of as many of them as he, in his infinite wisdom, considers it right to save. This part of his purpose was rendered necessary, not by any limitation in the efficacy of the atonement, not by his unwillingness to apply its efficacy to the whole number of mankind, but by the unwillingness of men to avail themselves of the Savior provided for them. Here, it is claimed, election comes in to secure the willingness of a part of those whose unwillingness, with all that it implies, is the one obstacle in the way of their being saved. This election is represented as made in the exercise of infinite knowledge concerning all that is right. It was prompted by the same infinite love to mankind that gave the Son of God to die for the whole world. Therefore it included all whom infinite power, wisdom, justice, and love would enable God to make willing in view of all the considerations that can and should enter into the question. The object of the election was to secure salvation, not to hinder or restrict it; and—the argument continues—as it was rendered necessary only by man's unwillingness to accept the provision made for him, if men suppose it certain or possible that any will of themselves accept the Savior, they are bound to suppose that the election has not shut such persons out, has not diminished any prospect or possibility of being saved which they may be thought to have irrespective of God's choice. The election was made not as an arbitrary intrusion into the divine governmental order, but with a perfect view and recognition of all the principles which God has established for the administration of his government: of his promise to hear prayer, to give the Holy Spirit to those who ask, to pour out his influences on all flesh, to prosper the right use of appropriate means, and to bless all wise and faithful efforts of men for the salvation of their fellow-men.

The view above given is in general the Calvinistic view; though different schools of Calvinist theologians differ in their shading of certain points on this subject; and it is probably the fact that the presentation of the whole doctrine in preaching at the present day is with less emphasis and stress than formerly on the points which are distinctive from Arminianism. Arminianism—at least as now held—equally with Calvinism, affirms the Divine foreknowledge and fore-ordination, and that neither precedes the other in time—both being eternal. But while Calvinism makes foreknowledge dependent in its nature on fore-ordination, Arminianism tends to make fore-ordination dependent, in the order of nature, on foreknowledge. If the debate were strictly limited to this one issue, it may be doubted whether either side could be conclusively proved as against the other. There are, however, other points of philosophical divergence. See ARMINIUS, CALVINISM, ELECTION, PREDESTINATION, *ante*.

FORELAND, NORTH and SOUTH, two promontories on the e. coast of Kent, between which are the Downs and Goodwin sands. North F., the *Cantium* of Ptolemy, forms the n.e. angle of the county and of Thanet isle, in lat. 51° 22′ n., and long. 1° 26′ e., 2 m. e. of Margate. It consists of chalky cliffs, nearly 200 ft. high, projecting into the North sea, and has a light-house, with a fixed light, 184 ft. high, and seen 24 m. off. South F., also composed of chalk cliffs, is 16 m. s. of North F., 3 m. n.e. of Dover, in lat. 51° 8′ n., and 1° 22′ east. It has two fixed lights, respectively 380 and 275 ft. above the sea, and seen from a distance of 25 and 22 miles. From this point, there is often a magnificent view of 200 to 300 merchantmen passing by, after having been detained by contrary winds in the Downs.

FORELOCK is a flat wedge driven through the end of a bolt to prevent its withdrawal: it is used principally on board ship.

FORESHORTENING, a term in painting or drawing, applied to signify that a figure or a portion of a figure, which is intended to be viewed by the spectator directly or nearly in front, is so represented as to convey the notion of its being projected forward;

and, though by mere comparative measurement occupying a much smaller space on the surface, yet to give the same idea of length or size as if it had been projected laterally. In compositions of figures and groups on ceilings, and in the interior of domes, etc., numerous examples will be found in which this art has been put in practice; in the works of Raphael, F. is practiced with most judgment and correctness; those of M. Angelo, Correggio, and Tintoretto display the greatest boldness; but the three last-named artists have been censured for introducing F. too frequently into their compositions, for the purpose of parading their skill in practicing it.

FOREST, a co. in n.w. Pennsylvania, on the Allegheny and Clarion rivers, traversed by the Pittsburg, Titusville, and Buffalo railroad; 376 sq.m.; pop. '70, 4,010. The surface is hilly, and mostly covered with forests. Co. seat, Tionesta.

FORESTALLING. See ENGROSSING.

FOREST FLY, *Hippobosca equina*, an insect of the order *diptera*. It receives the name F. F. from its frequent occurrence in forests, and particularly in the New Forest, Hampshire. It is also sometimes called HORSE FLY, from the annoyance which it gives to horses. It is a small insect, about four lines long; its wings, two in number, much exceeding the length of the abdomen. When at rest, the wings are laid flat on the back, one overlapping the other. The general color is brown, the thorax varied with pale yellow, the legs ringed with yellow and brown. The legs terminate in hooked claws. The skin is leathery and remarkably tough, so that the insect cannot be killed by any ordinary amount of squeezing. The structure of the mouth differs much from that of ordinary dipterous insects, and bears no inconsiderable resemblance to that of fleas. The F. F. lives by sucking the blood of quadrupeds, sometimes of oxen, dogs, etc., but most of all of horses. High-bred horses with smooth hair are most liable to this annoyance. The female F. F. does not deposit her eggs until they have reached the pupa stage in her abdomen. One only is produced at a time, inclosed in a tough, strong skin, egg-like, black, and shining like a bead, wonderfully large when the size of the abdomen from which it came is considered; the perfect insect finally emerges by bursting open a kind of lid or cap.

FOREST GROVE, a village in Washington co., Oregon, on the Oregon Central railroad, 25 m. w. of Portland. It is the seat of the Pacific university, under the charge of the Congregationalists.

FORESTI, E. FELICE, LL.D., 1793–1858; an Italian scholar, and prætor of Crespino in 1816. In Jan., 1819, he was arrested as one of the Carbonari, and kept in prison 17 years. In 1836, he came to New York, and was for more than 20 years professor of Italian in Columbia college. In 1858, he was appointed consul at Genoa. He published *Twenty Years in the Dungeons of Austria*, an edition of Ollendorf's Italian grammar, and an Italian chrestomathy.

FOREST LAWS, in England, laws for the regulation of the royal forests. Forest is defined by lord Coke to be a safe preserve for wild animals (*feræ*) of the chase, whence comes the term *foresta*, by the change of *e* into *o* (*Co. Litt.* 233 a). Both words probably spring from the same root as the Latin *foris* and the French *hors*, and signify that which is *without* the range of the peopled or cultivated country. Hence the Italian *forestiere* and *foresto*, and the Spanish *forestero*, signify strange, foreign, wild, and the like. A forest, in the sense of the law of England, is a large tract of open ground, not necessarily covered with wood, but usually containing woodland interspersed with pasture, and forming part of the property of the monarch, and governed by a special code, called the forest law. This particular law had reference not only to matters connected with hunting and the like, but generally governed the persons living within the forest in all their relations. A chase is a smaller forest, in the hand of a subject, but not governed by forest law. Though the privilege of forest belongs of right to the sovereign alone, it may be granted by him in favor of a subject, who becomes entitled to exercise the privileges of forest in the district assigned. This right was exercised by the Saxon kings, who reserved large tracts of country for the royal pastime of hunting, and a charter of the forest was said to have been passed by Canute at Winchester in the year 1016. But the authenticity of this document is doubted by lord Coke (*Inst.* iv. 320). William the conqueror greatly extended the royal forests, by laying desert vast districts in Hampshire and Yorkshire; he also introduced penalties of the severest kind for offenses against the game. The penalty for killing a stag or boar was loss of eyes; for William loved the great game as if he had been their father (*Sax. Chronicle*). It was not till the reign of Henry III. that the laws of the forest were reduced into a regular code. In the reign of that monarch was passed the charter of the forest, 9 Henry III. (A.D. 1224). The right of the sovereign to create a forest is by the common law confined to lands of his own demesne. Henry II. had arbitrarily exercised his power by afforesting the lands of his subjects; but by the 1st and 3d chapters of the charter of the forest, it is provided that all forests so made should be disafforested. At a subsequent time, when Henry VIII. created Hampton court forest, he was obliged to obtain the consent of the freeholders before he could erect a chase or forest over their grounds (Coke, *Inst.* iv. 301). Mr. Hallam remarks: "It is well known that Charles I. made Richmond park by means of depriving many proprietors not only of their common

rights, but of their freehold lands. It is not clear that they were ever compensated; but I think this probable, as the matter excited no great clamor in the long parliament."—Hallam, *Const. Hist.* i. 463, note, 1st edition. By the charter of the forest, the penalties for destroying game are greatly modified. By cap. 10, it is provided that no man shall lose life or limb for slaying deer, but that the punishment shall be restricted to fine or imprisonment for year and day. Cap. 11 contains the following curious privilege: "Whatsoever archbishop, bishop, earl, or baron, coming to us at our commandment, passing by our forest, it shall be lawful for him to take and kill one or two of our deer by view of our forester if he be present; or else he shall cause one to blow an horn for him, that he seem not to steal our deer; and likewise they shall do returning from us." This law is still unrepealed; so that a bishop may kill the queen's deer when summoned to, or returning from parliament. Charles I. attempted to fill his empty exchequer by imposing penalties and exacting fines for alleged encroachments on the ancient boundaries of the forests, though the right to the lands thus taken was fortified by possession for several centuries. This was one of the first grievances with which the long parliament dealt, and since the passing of the act for the "certainty of forests" (16 Car. I. c. 16), the laws of the forest have practically ceased. In Coke's time, there were 69 royal forests, all of which, with the exception of the New forest and Hampton court forest, had been created before the period of record. Of these, the principal were the New forest, Sherwood, Dean, Windsor, Epping, Dartmoor, Wichwood, in Oxfordshire; Salcey, Whittlebury, and Rockingham, in Northamptonshire; Waltham, in Lincolnshire; and Richmond, in Yorkshire. During the present reign, several of the royal forests have been disafforested by act of parliament—Hainault, 14 and 15 Vict. c. 43; Whittlewood, 16 and 17 Vict. c. 42; Wichwood, 19 and 20 Vict. c. 32. Public necessity is the plea on which these spots, long so famous for their sylvan scenery, have been condemned. The plea is one which cannot be altogether disregarded; but it is to be hoped that it will not be suffered to prevail to the entire destruction of our royal forests, some of which, from their vicinity to large towns, afford resorts for public recreation highly prized by the citizens, and which never can be equaled in beauty and in healthfulness by any new-made pleasure-ground.

The royal forests of Scotland, in ancient times, seem to have been nearly as numerous as those of England. In Perthshire, there were the forests of Athole, Mamlorn, Glenartney, Glenfynlas, Glenalmond, Birnam, Cluny, Alyth, etc. In Forfarshire, there were Platan, Montrethmont, Kilgerry; in Kincardineshire, Cowie and Durris; in Aberdeenshire, the Stocket, Dyce, Kintore, Benachie, Drum, Birse, Braemar; in Banffshire, the Boyne and the Enzie; in Morayshire, Darnaway, etc. South of the Forth, there were the forests of the Torwood, Cadzow, Ettrick, Selkirk, Jedburgh, Traquair, the New forest in Dumfriesshire, etc. The *Leges Forestarum*—the Scottish forest laws—have been printed more than once; the best edition is in *The Acts of the Parliaments of Scotland*, vol. i. pp. 323–328 (Edin. 1844). The forest code of Scotland, though neither so complete nor administered with the same rigor as that of England, was still generally complained of for its severe penalties or vexatious restraints. The grant of a right of forestry conferred the same privilege as if the ground over which it extended had been originally, and had continued to be, a king's forest. Hence arose great oppression and annoyance to neighboring proprietors, and in 1680 the supreme civil court suggested that a representation should be made to the king against the granting of new forests. From a case which was recently decided, it would seem that the high pretensions of royal foresters have in some places survived to the present day. The dukes of Athole still hold the extensive mountainous district called the forest of Athole, either in their own right or as foresters for the crown. In virtue of his rights of forestry, the sixth duke claimed the power of preventing his neighbor, the laird of Lude, from killing deer on his own lands, and maintained that he was bound to allow the duke and his keepers to enter on his lands, and drive back any deer that might stray upon them from the forest of Athole. But the court decided (Mar. 1, 1862) against the duke on both points.

Forest courts were courts established for the purpose of enforcing the F. L. in the royal forests. Of these courts, there were in England four—viz., the court of attachments, the court of regard, the court of swainmote, and the court of the lord justice in eyre in the forest, or justice seat. The last court of justice seat that was held where business was transacted was in the reign of Charles I., before lord Holland.

FOREST MARBLE, a member of the lower oolite, so called because of the occurrence of the typical beds in Wichwood forest, Oxfordshire. The principal bed is a fissile limestone, containing large numbers of dark-colored shells, and capable of sustaining a fine polish. On this account, it is used to some extent as "marble." It is interstratified with blue marls and shales, and fine oolitic sandstones. The whole thickness of the group seldom exceeds 40 feet.

FOREST OAK, a name sometimes given in commerce to the timber of *casuarina torulosa*, and other species of *casuarina* (q.v.), Australian trees. This timber, which is light yellowish-brown, and prettily marked with short red veins, is imported into Britain, and used for ornamental work.

FORESTS. See ARBORICULTURE.

FORESTS, Fossil, have been frequently observed in the coal measures. The seams of coal having in general been formed from the vegetation of the locality where they occur, it is to be expected that when the coal is removed, the stools and roots of the trees would be observed in the immediately subjacent bed of shale—the ancient soil. Such a forest was laid bare in an open work at Parkfield colliery, near Wolverhampton, in 1844. In the space of about one fourth of an acre, the stumps of 73 trees, with their roots attached, appeared. The trunks, broken off close to the root, were lying prostrate in every direction, often crossing each other. One of them measured 15, another 30 ft. in length, but they were generally shorter. They were invariably converted into coal, and flattened to the thickness of 1 or 2 inches. The upright stems show that some of them had a circumference of more that 8 feet. Similar F. F. have been observed in the coal-fields of Nova Scotia, and have been carefully described by Lyell, Logan, and Dawson. The usual height of the trees observed by Lyell was from 6 to 8 ft.; but one tree was about 25 ft. high, and 4 ft. in diameter. Brogniart describes the remains of a fossil forest preserved in an upright position, in strata of micaceous sandstone, belonging to the coal measures at St. Etienne, near Lyons. Though most abundant in strata of the carboniferous period, F. F. have been observed in other formations. The dirt-bed (q.v.) of the lower Purbeck series is the remains of an ancient forest. Instances are also abundant in the pliocene strata. Sometimes, as on the coast of Devonshire and on the shores of the firth of Tay, they are exposed on the surface, stretching from high-water mark to far below the furthest limit of low water; or they are exhibited in section, as in the cliffs of eastern Norfolk, where, resting on the chalk or crag, there is a stratum in which the stools and roots of the trees stand in their natural position, the trunks having been broken short off, and imbedded with their branches and leaves. This stratum is covered with fresh-water beds and drift. The position of these forests indicates a variation, in recent geological time, of the relative level of land and water. The instances in Devonshire and Fifeshire may imply a simple subsidence of the land; at Norwich, however, a considerable depression must have taken place, to admit of the deposition of the fresh-water beds and the till, and a subsequent elevation, to expose the beds so high above the sea-level.

The remains of ancient forests, belonging to a yet later period, are to be found in beds of peat. There is good evidence that some kinds of peat had their origin in the destruction of forests. Trunks and branches of beech, hazel, fir, etc., are found in them, and their roots may be traced in the underclay. The rapidity with which this peat is formed is very remarkable. At Blair-Drummond, the stratum of peat is 8 to 10, and in some places even 20 ft. in thickness. Many of the trees here have been felled with the ax, and that this was done while the Romans were in possession of the country is proved by the discovery of "corduroy roads," leading from one camp to another, and the finding of camp-kettles at the bottom of the peat.

FOREY, Elie Frederic, 1804–72; a French soldier accompanying the first expedition to Algeria in 1844. He became a gen. in 1848, and in 1851 was made commander of the legion of honor in recognition of his firing on the opponents of the *coup d'état*. In 1854, he was at Sebastopol; in 1859, he was the first to inflict disaster upon the Austrians at Montebello, and he was conspicuous in many other engagements. He was with Bazaine in Mexico, where he was military and civil administrator and minister plenipotentiary; was made a marshal in 1863, and given command of a *corps d'armée*.

FORFANG, or Forefang (Sax. *fore*, before, and *fangen*, to take), the taking of provisions from any one in fairs or markets, before the king's purveyors were served with necessaries for his majesty. (Charter of Henry I. to the hospital of St. Bartholomew in London, anno 1133, referred to in Tomlin's *Dic.*) It is also used to signify the rescuing of stolen or strayed cattle from a thief, or from those having illegal possession of them; or the reward fixed for such rescue (Wharton's *Dic.*).

FORFAR, supposed to be the ancient *Orrea*, the county t. of Angus or Forfarshire, situated near a small lake of the same name, on a rising-ground of no great height, in the fertile valley of Strathmore. Pop. '71, 11,031. It has been a royal burgh since the reign of king David I. (1124–53). It had a royal castle, of which no vestige remains, said to have been situated on a round hill, on the n. side of the town, and to have been destroyed by order of king Robert Bruce, in the year 1307. Its staple manufacture is linen. It is connected by railway with Aberdeen, Arbroath, and the south. It joins with Montrose, Arbroath, Brechin, and Bervie, in sending a representative to parliament.

FORFARSHIRE, or Angus, is a maritime co. in the e. of Scotland, being bounded on the e. by the German ocean, on the n. by Kincardine and Aberdeen shires, on the w. by Perthshire, and on the s. by the firth of Tay. It extends from n. to s. 33 m., and from e. to w. 27 m., with 45 m. of coast. There are several valleys of considerable extent, the principal of which are Glen Isla, Glen Prosen, Glen Esk, Clova, and Lethnot, which are all well watered, and mostly productive. The surface of the county is irregular, and it is intersected with hills, the Sidlaw being 1400 ft. high, and Catlaw, the highest, 2,264 feet. The soil, which is various, ranging from the finest alluvial to the moorish, rests mostly on the old red sandstone and the trap. Devonian paving-stones, limestone, porphyry, and jasper, occur. The chief rivers are the Tay, North Esk, South Esk, and

Isla; and there are some small lochs. Forfarshire is the chief seat of the Scotch linen manufacture. Cattle, corn, salmon, and paving-stone are the principal exports. The climate partakes of the qualities common to the e. coast. The average of the fall of rain is about 25 inches. The valued rent of the county in 1674 was £171,440 Scots, or £14,287 sterling. The valuation for 1875-76 was £630,298 sterling, including £75,536 of railways. In 1875, according to the agricultural returns of Great Britain, the total acreage in the county of all kinds of crops, bare fallow, and grass, was 249,413; under corn crops, there were 96,089 acres; under green crops, 50,484; and of clover, sainfoin, and grasses under rotation, there were 74,959. The total number of cattle returned for 1875 was 50,591; sheep, 121,937; pigs, 6,918. The number of horses used solely for agriculture, etc., returned by occupiers of land in the same year, was 9,988. Pop. '71, 237,528, being an increase over that of 1861 of 30,832. The chief towns are Dundee, Arbroath, Montrose, Forfar (the county town), Brechin, and Kirriemuir. The county returns one member to parliament, and the boroughs two. Angus was the province of a *Mormaer* during the Celtic period of Scottish history. It appears as an earldom in the 12th century. Its first earls were probably the descendants of the old *Mormaers;* it passed subsequently to the Umphravilles, the Stewarts, and the Douglases. The castle of Forfar was the residence occasionally of some of the kings, until the time of Alexander III. The chief antiquities are some Roman camps, the vitrified fort of Finhaven, the remarkable stone forts of the White Caterthun, near Brechin, and of the Laws, near Dundee; the sculptured stone pillars at Meigle, Aberlemno, St. Vigean's, Glammis, Kirriemuir, Aldbar, Invergowrie, etc.; the fortified island of St. Margaret's Inch in the loch of Forfar, the round tower and cathedral of Brechin, the ruins of Restennet priory and Arbroath abbey; and the old baronial castles of Glammis, Red castle, Edzell, Melgund, Finhaven, Airlie, Careston, Inverquharity. At Stracathro, it is said Baliol resigned the crown to Edward I. Several eminent men were born in this county—Hector Boece, Andrew Melville, the marquis of Montrose, Joseph Hume, sir Alexander Burnes, Robert Brown the botanist, James Mill the historian of British India; and Graham of Claverhouse had a seat at Fintry Mains.

FORFEITURE has never existed in the United States as a punishment for crime, except in rare instances. Non-forfeiture is a natural sequence of the provision in the federal constitution against attainder. But there are certain offenses in regard to which particular statutes have been enacted by congress exacting the forfeiture of property employed as a means of committing the wrongful act or used in an unlawful transaction; but forfeiture in such cases applies only to the particular property designated, and not generally to chattels or lands, as in the other instances which have been maintained. Thus, laws have been passed from time to time providing that smuggling or importation of goods under fraudulent invoices shall cause a forfeiture either of the entire invoice or of the property wrongfully imported. Acts of piracy entail a forfeiture of the piratical craft and its appurtenances. The same was true of vessels engaged in the slave-trade.

FORFEITURE AND CORRUPTION OF BLOOD are penalties consequent on convictions for treason or felony. The penalty of forfeiture for treason is founded on this consideration, that he who hath thus violated the first principles of government, and broken his part in the original contract between king and people, hath abandoned his connection with society, and hath no longer any right to those advantages which before belonged to him purely as a member of the community" (Stephen's *Com.* iv. 497). The penalty of forfeiture for treason prevailed in England before the conquest, as is clear from the fact, that lands held in gavelkind, which is a Saxon tenure, may be forfeited for treason. But after the conquest, forfeiture of lands and goods came to be regarded as the peculiar punishment of felony, of which treason against the sovereign was the highest kind, and was denominated high treason, to distinguish it from all other felonies, which were called petty treason. In cases of treason, the offender forfeits all his lands absolutely to the crown. In felony, according to the old law, the offender forfeited to the crown the profits of all estates of freehold during his life, and all his estates in fee-simple for a year and a day, after which they became escheat to the lord. The crown, during the year of occupancy, was entitled to commit upon the lands what waste (q.v.) it pleased. By *magna charta*, this power of committing waste was restrained. But by 17 Ed. II. c. 16, the king's title to waste was again recognized. As the law now stands, murder is the only felony by which forfeiture for year and day is incurred. In all felonies, the goods and chattels of the offender are, on conviction, forfeited to the crown; but until conviction, forfeiture of the goods does not operate. Where, therefore, a person has disposed of his goods before conviction, the crown cannot reach them. Forfeiture of lands does not take effect until sentence of attainder (q.v.) has been pronounced. So that a person committing *felo de se* (q.v.), or a rebel dying before sentence, or killed in open rebellion, does not forfeit his lands. But sentence of attainder, as soon as pronounced, has a retroactive effect, and annuls all conveyances made between the act of treason or felony and the pronouncing of sentence. Conveyances made before the act of treason are not affected. Hence, a wife's jointure is not forfeited, because settled on her before the commission of the act. But dower is forfeited by 5 and 6 Ed. VI. c. 11. Counterfeiting the coin was formerly treason; but by various statutes, it is provided that

the wife's dower should not be forfeited, and that the lands should be forfeited only for the life of the offender. Forfeiture for treason and felony is accompanied by *corruption of blood*, whereby the offender is incapable of inheriting any lands or of transmitting any title to an heir. But where the lands were not vested in the offender at the time of the act, they are not forfeited to the crown, but to the overlord. In England, this distinction is of little moment, except in copyhold lands, the crown being, in fact, the overlord of nearly all the freehold land in the kingdom. By 7 Anne, c. 21, it was enacted that, after the death of the pretender and his sons, no attainder for treason should operate to the prejudice of other than the offender himself; but this provision was repealed, 39 Geo. III. c. 93. But in Scotland, where subinfeudation still subsists, the distinction is of practical importance. In Scotland, before the union, forfeiture of estate was incurred on account of treason and certain other crimes, as theft by a landed man, and uttering false coin. Lord Stair is of opinion that the doctrine of corruption of blood did not prevail in Scotland to exclude those claiming, through a person attainted, where the offender was only apparent heir (Stair, iii. 3, 38). Since the union, the law of Scotland in regard to forfeiture for treason has been assimilated to that of England.

In America, forfeiture of estate for crimes is very much reduced, and the corruption of blood is universally abolished. Several of the state constitutions have provided that no attainder for treason or felony shall work corruption of blood or forfeiture of estate, except during the life of the offender, and some of them have taken away the power of forfeiture absolutely, without any such exemption. Every person convicted of any manner of treason, under the laws of New York, forfeits his goods and chattels, and also his lands and tenements, during his lifetime; but the rights of all third persons existing at the time of the commission of the treason, are preserved. Kent's *Commentaries*, ii. 505.

FORFEITURE OF LANDS was originally a penalty of the feudal law, incurred on account of some act by the tenant inferring disloyalty to his overlord. The acts inferring forfeiture might be of either a civil or a criminal nature. Forfeiture for crimes was incurred by treason or felony. See FORFEITURE AND CORRUPTION OF BLOOD. Civil forfeiture may be incurred in England in three ways—viz., by tortious alienation, by wrongful disclaimer, and by alienation in mortmain; the first two of these modes were incidents of the feudal tenure, the latter was introduced by statute. It must be observed that, according to the earliest feudal customs, a gift of lands was always made in favor of a particular person, and that alienation, without consent of the overlord, involved a forfeiture of the fee. But this strictness having by degrees ceased to be observed, forfeiture was only incurred in case of a tortious alienation. Tortious alienation was where the owner of a partieular estate conveyed by common-law conveyance, as feoffment, fine, or recovery, a greater estate than that to which he was himself entitled, as where a tenant-for-life made a feoffment in fee. The immediate effect of this act was the forfeiture of the land to the remainder man or reversioner. By 3 and 4 Will. IV. c. 74, abolishing fines and recoveries, and 8 and 9 Vict. c. 106, s. 4, declaring that a feoffment should not have a tortious operation, forfeiture by tortious alienation has ceased to have a practical importance. Forfeiture by wrongful disclaimer was where a tenant holding under a superior lord, on being summoned in any court of record, either disclaims his allegiance, or does any act which amounts to a disclaimer. Since the abolition by the statute of *quia emptores*, of subinfeudation, this species of forfeiture can only arise in lands held of the crown. Forfeiture by alienation in mortmain is incurred by the conveyance of lands or tenements in favor of any corporation (q.v.), sole or aggregate, ecclesiastical or temporal. As by vesting the land in a tenant of this description, the overlord was deprived of all the duties and services due by his vassal, this act was declared by various acts of parliament to infer the forfeiture of the lands. See MORTMAIN. Forfeiture of copyholds was incurred by committing waste, and by other acts of a wrongful kind inconsistent with the fealty due to the lord. See Blackstone, *Com.* ii. 284. Forfeiture on breach of condition subsequent, is where an estate is held upon a condition contained in the grant itself. On failure of the condition, the granter or his heirs may enter upon the lands.

In Scotland, civil forfeiture may arise either from statutory enactment, at common law, or by agreement. By 1597 c. 246, it is enacted that vassals failing to pay their feu-duties for two years shall forfeit their right. This forfeiture must be established by an action to recover the feu-duties in arrear, and may be avoided by payment at the bar. At common law, a vassal forfeited his land by disclamation or purpresture. The former is analogous to the English disclaimer, and consists in the denial by a vassal of his lawful superior. Purpresture was incurred by the vassal's encroachment on the streets, highways, or commonties belonging to the crown or other superior. These forms of forfeiture are fallen into disuse. Forfeiture on special agreement depends wholly upon the terms of the condition inserted in the titles to the land. The condition must be fortified by irritant and resolutive clauses, and must enter the sasine, in order that it may be effectual against purchasers of the lands (Erskine, ii. 3, s. 13). Of this kind of forfeiture are breaches of entails (q.v.).

FORGE—FORGING. The process of hammering red-hot iron or steel into any required shape is called forging, and the workshop in which the operation is performed, a forge. The principal tools of a common smith's forge are the forge-fire or hearth, with its bel-

lows, the anvil, and the various hammers, swages, etc. For large work, an air-furnace, blown by steam-bellows, supplies the place of the simple hearth of the blacksmith, powerful cranes swing the work to its place on the anvil, and a steam-hammer (see HAMMER) strikes the blows that squeeze the red-hot mass into shape. Besides these, there are portable forges of various sizes and forms, used for military and other purposes. They usually consist of an iron frame, to which a bellows, worked by the foot, is attached; and above the bellows is an iron tray, with a hearth, etc., upon which the fire is made; and the anvil is either attached to this frame, or has a separate stand.

Under CUTLERY, the general method of forging small work is described. For the largest work to which hand-hammers are still applied, such as anchor-forging, two gangs of from six to twelve hammermen are employed; they swing the large hammers with such wonderful precision and regularity, that the instant one hammer is withdrawn, another falls upon the same place. A foreman, with a wand, directs the hammering. The two gangs relieve each other alternately, on account of the great severity of the labor. Shovels, spades, mattocks, and many other tools and implements, are partly forged under the tilt-hammer. See IRON.

In all processes of forging, it is of primary importance to obtain the greatest possible rapidity in the succession of the blows. There is a double reason for this: first, and simply, that the work is cooling, and the more slowly it is forged, the more frequently it must be reheated; and secondly, that percussion generates actual heat, and if the blows are sufficiently heavy and rapid, the temperature of the work may be fully maintained out of the fire for a considerable length of time. The hammer used for tilting steel not only maintains the heat of the bar, but raises it from a dull to a bright red heat.

FORGERY (Fr. *forger*, to form metal into shape; to fabricate), the *crimen falsi* of the Roman law, is held in England, at common law, to be the fraudulent making or altering of a writing or seal, to the prejudice of another man's right, or of a stamp to the prejudice of the revenue. As regards writings, the instrument forged must be executed with such skill or in such circumstances as to be capable of being mistaken for a genuine document by a person of ordinary intelligence and observation. It is not necessary that there should be even an attempt at imitation. If there was intention to deceive, and the circumstances were such as to render deception possible, the crime has been committed, and it has consequently been held in Scotland that it is possible to forge the name of a person who cannot write (1 Alison, p. 372), and further that the crime may be committed by the adhibition of a cross or mark (Macmillan, Jan. 24, 1859). Any material alteration, however slight, is a F. just as much as the subscription of the name of the pretended maker, or the fabrication of the entire deed. It will not lessen the crime, though the whole deed should be genuine, the name only being forged, or the name being really the handwriting of the party to whom it belongs, but appended to a forged deed. Even if the name be a fictitious one, but appended for the purpose of deceiving, a F. has been committed just as much as if it belonged to a real person. Long before the recent extensions took place in the law of evidence, by which parties were admitted as witnesses in their own causes, it was provided by 9 Geo. IV. c. 32, that the party whose name had been forged might be a witness to the effect that the writing was not his. But, on the other hand, it is an established rule of law that the proof of F., by a mere comparison of handwriting, is incompetent (Tailor on *Evidence*, p. 1428, n. 5, 2d ed.). Identification of handwriting is, if possible, more difficult than identification of the person, which so often forms the chief difficulty in criminal trials. "As illness, strange dress, unusual attitude, and the like, cause mistakes in identifying the individual, so a bad pen, or rough paper, a shaking hand, hurry, and many other things, change the appearance of a person's handwriting."—Dickson on *Evidence*, p. 474. There are besides resemblances in handwritings proceeding from many accidental causes, so that much caution is necessary in weighing this kind of evidence. "It ought never, therefore, to be regarded as full proof by the crown in criminal trials, and even in civil cases, corroborative evidence should be required, unless the proof of handwriting is so clear as to shift the *onus probandi.*" Though writing-masters, engravers, bankers' clerks, and other persons in the habit of examining handwritings, are often adduced as witnesses in trials for F., their evidence is really of very little value, and generally so conflicting that it can be produced with equal effect on either side. The best witness is one who has often seen the party write, through whose hands his writing has been continually passing, and whose opinion is not the result of an inspection made on a particular occasion for a special purpose. The act 11 Geo. IV., and 1 Will. IV. c. 66, makes the forging of the great seal, the privy seal, or any privy signet, the sign-manual, the seals of Scotland, or the great seal and privy seal of Ireland—treason. The same statute declares the offense of forging, or uttering with intent to defraud, stamps, exchequer bills, bank of England notes, bills of exchange, promissory notes, deeds, receipts, orders for the payment of money, transfers of stock, wills, etc., to be felony. Capital punishment was first abolished with regard to special cases of F. by 2 Geo. IV., and 1 Will. IV. c. 66, and 2 and 3 Will. IV. c. 123; and then altogether done away with by 7 Will. IV. and 1 Vict. c. 84. The offender is now liable to penal servitude, the length of which is at the discretion of the court; but which

cannot be for less than three years, or he may be imprisoned for not more than four, or less than two years, with or without hard labor and solitude. As to the F. of bank of England notes, see 16 Vict. c. 2. As to obtaining property by false pretenses, see FRAUD.

FORGET-ME-NOT, or SCORPION GRASS, *Myosotis*, a genus of annual or biennial herbaceous plants, of the natural order *boragineæ*, with 5-cleft calyx and salver-shaped corolla; the flowers small, and generally blue. The genus is diffused over the temperate zone in all quarters of the world, and a number of species are common in Britain, chiefly growing in ditches and damp meadows—as *myosotis palustris*, with crooked creeping perennial roots—an angular stem of a foot in height, and calyx covered with appressed bristles. *M. sylvatica*, with calyx covered with stiff spreading hairs, grows in bushy places and woods, and is often planted in flower-gardens. The dark-blue F. of the Azores (*M. Azorica*) has of late begun to be cultivated in Europe, but requires the green-house. The genus is a favorite one with most persons, both because of the brilliancy of the flowers, and because throughout Europe it is generally regarded as the emblem of friendship. The English name scorpion grass is now seldom heard. The German name *vergissmeinnicht* corresponds with the English *forget-me-not.*—*M. versicolor*, very common in Britain, often as a weed in gardens, is remarkable for the change of color in the flowers, which are first yellow, then blue. They are very small.—*M. alpestris*, found on some of the mountains of Scotland, is especially admired for the size and brilliancy of its flowers.

FORIO, a thriving t. of Italy, is picturesquely situated on the w. coast of the island of Ischia, which stands at the northern side of the mouth of the bay of Naples. The central portion of the town consists of very narrow streets, but the suburbs are composed of charming white cottages. It has three highly decorated churches, a good harbor, and some trade with Leghorn, Naples, and Genoa, Pop. 5,791.

FORISFAMILIA'TION (literally, the putting forth from or beyond the family) is the separation of a child from the family of his father. A child is said to be forisfamiliated, either when he marries or when he receives from his father a separate stock, the profits of which are enjoyed by himself, though he may still reside with his father, or when he goes to live in another family with the consent of his father. The same result is also brought about when a child renounces his *legitim*, i.e., his legal share of the father's free movable property due to him on the death of the latter. See Bell's *Dic. of the Law of Scotland.*

FORKED BEARD, *Phycis furcatus*, and *Raniceps trifurcatus*—the first being the largest—a fish of the cod family found on the w. coast of Europe. In the United States it is called "hake," but is a much better fish than the true hake.

FORKEL, JOHANN NIKOLAUS, 1749–1818; a native of Saxony, who acquired great reputation as a pianoforte player and a writer on the history and science of music. He was director of music at the university of Göttingen. His most important work is *General History of Music.*

FORKS. These table instruments are only about three centuries old. The Greeks, Romans, and other ancient nations knew nothing of forks. They had large F. for hay, and also iron F. for taking meat out of pots, but no instruments of the nature of table-forks. In ancient times, as is the practice still in the East, meat was commonly prepared as stews; or if roasted, it was cut into small pieces by a carver, so as to be easily taken in mouthfuls by the guests, who used their fingers and a knife for the purpose. It certainly is a strange fact, that the use of any species of F. at table was quite unknown till the 15th c., and they were then known only in Italy, which has the merit of this invention. None of the sovereigns of England had F. till after the reign of Henry VIII.; all, high and low, used their fingers. It was accordingly a part of the etiquette of the table to employ the fingers so delicately as not to dirty the hand to any serious degree; but as even by the best management the fingers were less or more soiled, it was the custom to wash the hands immediately on the dishes being removed from the table. Hence, in the royal household, there was a dignitary called the *ewrar* or *ewary*, who with a set of subordinates attended at meals with basins, water, and towels. The office of ewary survived after F. came partially into use. We learn that when James I. entertained the Spanish ambassador at dinner, very shortly after his accession, "their majesties washed their hands with water from the same ewer, the towels being presented to the king by the lord treasurer, and to the queen by the lord high admiral." The prince of Wales had a ewer to himself, which was after him used by the ambassador.—Ellis's *Letters.* The first royal personage in England who is known to have had a fork was queen Elizabeth; but although several were presented to her, it remains doubtful whether she used them on ordinary occasions. From the inventory of her majesty's appointments in Nichols's *Progresses*, it would appear that these F. were more for ornament than use. "*Item*, a knife and a spoune, and a forke of christall, garnished with golde sleightly, and sparcks of garnetts: given by the countess of Lyncolne. *Item*, a forke of corall, slightly garnished with golde: given by Mrs. Frances Drury. *Item*, one spoune and forke of golde: the forke garnished with two lyttle rubyes, two lyttle perles pendant, and a lyttle corall: given by the countess of War-

wicke." These ornamental F. had doubtless been presented to the queen as foreign curiosities of some value, and were probably never used at table. As yet, and for a considerable time afterwards, F. were not in common use, a circumstance less attributable to ignorance of the invention, than to prejudice. So far was this prejudice carried, by even educated persons, that one divine preached against the use of F., as being an insult to Providence not to touch one's meat with one's fingers!

Italy, as has been said, claims the merit of this useful invention. This fact is explicitly learned from an account of a tour in Italy by a traveler named Thomas Coryate, who visited that country in 1608. His travels, styled *Crudities*, were published first in 1611, and republished in 1776. In these *Crudities* appear the following passages respecting the Italian towns: "I observed a custom in all those Italian cities and townes through which I passed, that is not used in any other country that I saw in my travels; neither do I think that any other nation of Christendom doth use it, but only Italy. The Italian and also most strangers do always at their meals use a little forke when they cut their meat. For while with their knife, which they hold in one hand, they cut the meate out of the dish, they fasten the forke, which they hold in their other hand, upon the same dish; so that whatsoever he be that sitting in the company of others at meals, should unadvisedly touch the dish of meat with his fingers, from which all the table doe cut, he will give occasion of offence unto the company, as having transgressed the laws of good manners, in so much that for his error he shall be at the least browbeaten, if not reprehended in wordes. This form of feeding, I understand, is generally used in all places of Italy; their forks being for the most part made of yron, steele, and some of silver, but these are used only by gentlemen. The reason for this curiosity is, because the Italian cannot by any means indure to have his dish touched with fingers, seeing that all men's fingers are not alike cleane. Hereupon, I myself thought good to imitate the Italian fashion by this forked cutting of meate, not only while I was in Italy, but also in Germany, and oftentimes in England since I came home; being once quipped for that frequent using of my forke, by a certain learned gentleman, a familiar friend of mine, Mr. Laurence Whitaker, who in his merry humour, doubted not to call me at table *furcifer*, only for using a forke at feeding, but for no other cause." The term here employed jocularly, was in its serious meaning one of reproach, having been applied by the Romans to those slaves who as a punishment bore a forked frame or yoke (*furca*), resembling an inverted Λ—hence the Italian *forca* and *forchetta;* the latter (little fork) being followed in the French term *fourchette*, while the former is the root of the English word fork.

F. came so slowly into use in England, that they were employed only by the higher classes at the middle of the 17th century. About the period of the revolution, few noblemen had more than a dozen F. of silver, along with a few of iron or steel. At length, for general use, steel F. became an article of manufacture at Sheffield: at first, they had but two prongs, and it was only in later times that the three-pronged kind were made. As late as the early part of the 18th c., table-forks, and we may add knives, were kept on so meager a scale by country inns in Scotland (and, perhaps, also in some parts of England), that it was customary for gentlemen in traveling to carry with them a portable knife and fork in a shagreen case; and till this day a small knife and fork form part of the ornamental equipment in the Highland dress. The general introduction of silver F. into Great Britain is quite recent; it can be dated no further back than the opening of the continent to English tourists at the termination of the French war in 1814. The extensive use of these costly instruments in the present day, marks in an extraordinary degree the rapid progress of wealth and refined taste throughout the United Kingdom.

FORLI, a province in n.e. Italy bordering on the Adriatic; 716 sq.m.; pop. '72, 234,090. Near the sea the surface is low and level, but in the w. section it is mountainous. The chief productions are wines, hemp, flax, madder, silk, and anise. There has recently been a considerable advance in manufacturing.

FORLI, an interesting city of Italy, capital of the province of the same name, is beautifully situated at the foot of the Apennines, in a pleasant and fertile plain, on the right bank of the Montone, 16 m. s.w. of Ravenna. It is a well built, handsome city, surrounded with walls, and contains many striking specimens of architecture, of which the Guerini Palazzo, built after the designs of Michael Angelo, the Palazzo Comunale, the Monte di Pietà, the cathedral, a majestic building, and the churches of S. Philipo Neri, of S. Girolamo, and of S. Mercuriale, are the most notable. The ecclesiastical buildings of F. contain some of the best pictures of Cignani, Carlo Maratti, Guido, and other masters. The citadel, founded in 1361, is now used as a prison. The inhabitants carry on silk-spinning and salt-refining, with a considerable trade in corn, linen, hemp, carthamus, woad, etc. F. (the ancient *Forum Livii*) is said to have been founded by Marcus Livius Salinator, after his victory over Hasdrubal, on the Metaurus, 207 B.C., and to have received its name from him. In the middle ages, it formed a republic, and exchanged its rulers frequently during the struggles of the Guelphs and Ghibellines. In 1503, it was annexed to the states of the church, and so remained till 1860, when it was placed with the Æmilian provinces under the scepter of Victor Emmanuel. Pop. '72, 38,480; of prov. 234,090.

FORLI, MELOZZO DA, 1438–92; an Italian painter, the first to apply foreshortening to the painting of vaulted ceilings. In 1472, he painted "The Ascension," which is now in the Quirinal palace.

FORLORN-HOPE, the body of men selected to attempt a breach, or to lead in scaling the wall of a fortress. The name (which in the French, *enfants perdus*, is even more expressive) is given on account of the extreme danger to which the leaders of a storming-party are necessarily exposed. As, however, the honor of success is proportionate to the peril of the undertaking, there is ordinarily no lack of volunteers for this arduous service. The forlorn-hope is called by the Germans *Die verlornen Posten*.

FORM, in music, denotes both rhythmical structure and distinctive outline. F. holds to harmony a relation like that which, in drawing, outline holds to light, shade, and coloring.

FORM, in philosophy, or IDEA, the term which Plato used to express the reality of a thing; that which makes it what it is, and which continues always the same; in contrast with appearances and objects of sensation that pass away and are altered as they pass. The standard to which these are referred in the mind is a "form" or species, simple and uniform, always the same for each thing, and springing originally from the supreme mind, the Creator of all things, who has made each and every thing according to the idea or form of it pre-existing in his mind. Aristótle also used the word *form* as expressing the essence of a thing. Lord Bacon said: "When we speak of *forms*, we understand the laws and modes of action which regulate and constitute any simple nature, such as heat, light, weight, in all kinds of matter susceptible of them; so that the form of heat and the law of heat, or the form of light and the law of light, are the same thing." "The form of a thing is the very thing itself; and the thing no otherwise differs from the form than as the apparent differs from the existent, the outward from the inward, or that which is considered in relation to man from that which is considered in relation to the universe." Sir William Hamilton called the theory of substantial *forms* "the theory of qualities viewed as entities conjoined with matter, and not as mere dispositions or modifications of it." Dr. McCosh says that "the distinction between matter and form was first drawn by Aristotle, who represented every thing as having in itself both matter and form; but that a new meaning was attached to it by Kant, who supposed that the mind supplies from its own furniture a form for the matter presented to it from without. But this doctrine, if carried out, would sap the foundations of all knowledge; for if the mind may contribute from its own stores one element, why not another? Why not all elements? In fact, Kant did by this distinction open the way to all those later speculations which represent the whole universe as being an ideal construction. The truth is, that the mind does not of itself impose the form on the object, but is simply so constituted as to know what is in the object."

FORMA PAUPERIS, the phrase usually employed both in England and Scotland to signify the arrangements by which an action may be carried on by one who is too poor to sue in the ordinary way. In England, the statutes 11 Henry VII. c. 12, and 23 Henry VIII. c. 15, provide that such as will swear themselves not worth £5 except their wearing apparel and the matter in question in the cause, shall be exempt when plaintiffs, but not when defendants, from the payment of court-fees, and shall be entitled to have counsel and attorney assigned to them by the court without fee. They are further excused from costs when unsuccessful; a privilege which, according to Blackstone, amounted in former times only to the rather uncomfortable alternative of choosing between paying and being whipped. In the event of success, however, a person suing in this form is entitled to his costs, because his counsel and agent, and the officers of court, though they are bound to give their labor gratis to him, are not bound to give it on the same terms to his antagonist, unless he too be a pauper. To prevent the abuse of suing in the superior courts at Westminster in this form in matters of small amount, it is provided (19 and 20 Vict. c. 108, s. 30), subject to certain exceptions, that any plaintiff who resorts to one of these, in a case falling within the cognizance of a county court, and recovers no more than £20, or in some cases £5, shall have no costs, unless he satisfies the court or a judge that he had sufficient reason for taking that course. There are some other exceptions to the rule (see Stephen's *Com.* iii. p. 646).

In Scotland, this benevolent arrangement was introduced by statute more than half a century before the date of the English act we have mentioned. In 1424, the statute (c. 45), which we have already quoted under advocates (q.v.), was passed for the purpose of securing professional assistance, gratis, to the poor, and for giving to them and those who assisted them their costs in the event of success. The more special arrangements applicable to litigation in this form in Scotland will be detailed under poor's roll (q.v.).

FORMATION, in geology, is applied to a group of strata united by some character which they have in common, whether of age, origin, or composition, as the coal or chalk formation.

FORMEDON, an old form of action, in the law of England, whereby an heir of entail or remainder man who had been ousted by a discontinuance, was entitled to vindicate his claim to the lands from which he had been ousted. By 21 James I. c. 16, it

was enacted that writ of F. should be brought within 20 years of the time when the cause of action arose. Writ of F. is now abolished, together with other real actions.

FORMES, KARL JEAN, b. Baden, 1818; known as a basso singer, with a voice remarkable for depth and compass. He was compelled to leave Vienna on account of his revolutionary opinions, and went to London, where he was considered to be unsurpassed as a singer. In 1857, Formes came to America, which country and its people he greatly liked, and appeared in New York for several seasons. In later years his voice failed, and he attempted drama in London, but with no great success. His capacity of various expression in singing was recognized as the natural effect of an unusually broad intelligence.

FOR'MIA (formerly MOLA GAETA or CASTELMOLA), a t. of Italy, in the province of Caserta, near the ancient Via Appia, on the innermost recess of the gulf of Gaeta; pop. '71, 9,151. The surrounding country is occupied with vineyards, olive plantations, and fruit gardens. Formia occupies the site of the ancient Formiæ, said to have been founded by the Tyrrhenians. At an early period it received the Roman franchise and became a municipium. Villas were built near it by many of the noble Romans; and in the grounds of the villa Caposele there are ruins which are thought by some to have been the baths of the villa of Cicero. The villa Caposele was at one time one of the residences of the kings of Naples. The vine of the Formian hills produced excellent wine in the time of Horace.

FORMIC ACID (C_2HO_3,HO) derives its name from the circumstance of its having been first obtained from the *formica rufa*, or red ant. In a concentrated state, it is a fuming liquor with an irritating odor, and occasions vesication if dropped upon the skin. It crystallizes at a temperature below 32°, and boils at about 212°, yielding a vapor which burns with a blue flame. It is a strong reducing agent, at a boiling temperature reducing the salts of silver, mercury, platinum, and gold.

It may be obtained in various ways, as, for example: 1. By the distillation of red ants with water (a proceeding never adopted now). 2. By the distillation of a mixture of starch, binoxide of manganese, sulphuric acid, and water; this is the usual method, and various organic matters, as sugar, chaff, bran, saw-dust, etc., may be substituted for the starch. 3. By the distillation of oxalic acid mixed with sand, or far better (according to Berthelot), with glycerine; 1 equivalent of oxalic acid ($C_4O_6,2HO$) yielding 1 equivalent of formic acid (C_2HO_3,HO) + 2 equivalents of carbonic acid ($2CO_2$).

Berthelot has recently obtained it synthetically by keeping carbonic oxide gas for a prolonged period in contact with hydrate of potash, at a temperature of 212°. The gas becomes gradually absorbed, and formate of potash is the result, the reaction being exhibited by the formula, 1 equivalent of hydrate of potash (KO,HO) + 2 equivalents of carbonic oxide ($2CO$) = 1 equivalent of formate of potash (KO,C_2HO_3).

Formic acid is a very common product of the oxidation of organic bodies; thus, for example, the albuminates, glycine, sugar, starch, etc., yield it in association with other products, when acted on by chromic acid; the fats and fatty acids yield it when acted on by nitric acid; and it is a product of the action of ozone on glycerine, fats, fatty salts, acetic acid, and sugar, provided a free alkali is present. Hence we can readily explain its occurrence as a product of oxidation in the animal organism, in which it not unfrequently occurs, either free or in combination. Thus we find it not only in ants, but in the poison of the bee and wasp, and in the hairs of the procession caterpillar. It has been detected by various chemists in the sweat, in the expressed juice of the spleen, pancreas, thymus gland, and muscles, in the brain, the blood, and the urine.

The salts of formic acid, which are termed by some chemists formates, and by others formiates, require no special notice. They are all soluble, and yield a red color with persalts of iron.

FORMI'CA. See ANT.

FORMICATION, a peculiar sensation of the skin, such as might be produced by the creeping of multitudes of ants (*formica*) or other small insects. It is akin to the awakening from numbness, or of a limb being "asleep." It is sometimes a symptom of cerebral or spinal disease.

FORMING'S ISLAND is a speck on the bosom of the Pacific, lying a little to the n. of the Sandwich group, or Hawaiian archipelago, in lat. 30° 49' n., and long. 159° 20' west. It is one of the most recent additions to the British empire, having been formally occupied, mainly on account of its excellent harbor, towards the close of 1860.

FORMO'SA (Chinese name, *Tai-wan*), a large island on the s.e. coast of China, opposite the province of Fo-kien, from which it is distant about 90 miles. It lies between 21° 53' to 25° 16' n. lat., and 120° 15' to 122° 4' e. long. Length, about 237 m.; average breadth, about 70 miles. A chain of mountains nearly bisects the island, the eastern side of which is held by aboriginal savage tribes. These having massacred some shipwrecked Japanese sailors, were in 1874 attacked and punished by a Japanese force, which event nearly led to a war between China and Japan. The western side has been in possession of the Chinese since 1683, and is a department of the province of Fo-kien.

Pop. from 2 to 8 millions. Tai-wan-foo (q.v.), the capital, and Takao, on the w. coast, and Tamsui and Keelung on the n., have been opened to foreign commerce by treaties. Coal abounds at Kelung, and is largely shipped. Tea is extensively cultivatad; other products are camphor, rice, maize, sugar, tobacco, cinnamon, pepper, etc.; oranges, pine-apples, guavas, cocoa-nuts, grapes, peaches, etc, are abundant.

FORMOSA (*ante*), a Portuguese word meaning "formly," "beautiful," the Chinese name Tai-wan means "Great Terrace." F. is an island, lying off the coast of China, and is intersected by a range of volcanic mountains, running from n. to south. The western half only was formerly claimed by China, and in the native and Jesuit maps of the Chinese empire only that half was marked as Chinese territory. The eastern half. or aboriginal Formosa, was, from the 15th c., considered by the Japanese as part of their territory, as were the islands lying immediately adjacent. (See the works of Charlcroix and De Mailla.) The Dutch occupied a point called Zeelandia, a fort and town, from 1634 to 1662; and for this privilege paid tribute to the Japanese rulers in Yedo. When the persecution broke out in Japan, large numbers of native converts fled to Formosa and dwelt with the Dutch. In 1662, Koku-sen-ya ("Coxinga" of the Jesuits), a Japanese pagan half-breed, fitted out an expedition, attacked the Dutch forts, and slaughtered the traders, the missionaries, their families, and many of the Japanese converts. In Mar., 1867, the American brig *Rover* was driven ashore on the Vele-rete rocks, off southern Formosa, and the captain, his wife and crew were killed by the natives. In June, 1867, com. Bell having received instructions from Washington, sailed to Formosa with the *Hartford* and *Wyoming*, landed a force of 181 men, and attacked the Botan savages. The Americans were driven off with loss; the Chinese disavowing all responsibility over eastern Formosa. In Sept., 1867, gen. Le Gendre, U. S. consul at Amoy, visited Tokitok, the acknowledged head of the 18 savage tribes of the coast, and obtained a promise that the lives of shipwrecked Americans and Europeans should be respected. In Dec., 1871, a large fishing vessel from the Miyako group of islands lying e. of Formosa, was wrecked off the Botan territory; 54 of the crew were killed, and some, it was said, eaten by the Botans. The survivors who escaped reported the affair to the magistrates of Riu Kiu (Loo Choo), who begged the Japanese government for redress. June 8, 1874, the Japanese forces under general Saigo occupied a point at Laing Kioa bay, and for six months the 1300 troops remained in Formosa, making roads, and chastising the savages, the object of the Japanese being to reduce the country to order, survey the coast, and erect light-houses. The Peking government not relishing the bold action of their neighbors, and stirred up by foreign intrigue, demanded the withdrawal of the troops and menaced hostilities; but Okubo, the mikado's envoy in Peking, remained firm in his demand that China should reclaim and govern eastern Formosa, and pay the expenses of the Japanese occupation. The Chinese agreed, and paid 700,000 taels, Dec. 1, and gen. Saigo and the troops disembarked on the 3d. The loss of the Japanese by disease and in battle was 700 men. Japan by this expedition to Formosa spent $5,000,000 in the interests of civilization. The Chinese have since attempted to occupy and rule the savages of e. Formosa, with what success remains to be seen.

FORMOSUS, d. 896, the successor of Stephen V. as pope, first appears in history when as bishop of Porto, he was sent on an embassy to the Bulgarians. Having afterwards sided with the German faction against John VIII., he was excommunicated, and compelled to take an oath never to return to Rome, or again to assume his priestly functions. From this oath he was absolved by Martin II., the successor of John VIII., and restored to his dignities; and on the death of Stephen V., in 891, he was chosen pope. The Italian faction had chosen Sergius; and the election of Formosus, which was in opposition to an old rule against the translation of bishops from one see to another, could not be confirmed without violence, but was rendered secure for a time by the success of the arms of Arnulf of Germany. After the withdrawal of Arnulf, Formosus was compelled to grant the imperial crown to Lambert, son of Guido of Italy; but this act did not pacify the Italian faction, and Formosus was released from very hard straits only by the arrival of Arnulf, who captured the city in the end of 895. In the following year Arnulf was crowned emperor by Formosus; but before the death of the latter in May, the excesses of Arnulf and his soldiers had begun to create a strong opposition to the German power amongst all parties in Italy. By Stephen VI. the body of Formosus was disinterred, and treated with contumely as that of a usurper of the papal throne; but Theodorus II. restored it to Christian burial, and at a council presided over by John IX., the pontificate of Formosus was declared valid and all his acts confirmed.

FORMS OF ADDRESS. Many persons are exposed to inconvenience from their ignorance of the formal modes of addressing letters to persons of title; we shall, therefore, in the present article, give an enumeration, taken mainly from Mr. Dod's *Peerage and Baronage*, of the usual ceremonious modes of written address. Previous to their employment, the writer must, of course, learn either from the peerage-writers, or from some other source, the precise rank of the person whom he wishes to address, as well as the hereditary, personal, or official distinctions by which that rank is often modified.

1. *Archbishop*—Letters are addressed: "His Grace, the Lord Archbishop of ——," and commence: "My Lord Archbishop." More formal documents are addressed "The

Most Reverend Father in God (John Bird), by Divine Providence Lord Archbishop of Canterbury;" other archbishops and suffragan bishops being "by Divine permission." When personally referred to, an archbishop is styled "Your Grace," not "Your Lordship." The Archbishop of Armagh is addressed as "His Grace the Lord Primate of Ireland."

Archbishop's wives, and the other members of their families, enjoy no titles as such.

2. *Baron*—Addressed: "The Right Honorable Lord ——;" referred to as "His Lordship," or "Your Lordship."

Baron's Daughter—"The Honorable Mary ——;" or, if married, "The Honorable Mrs. ——." Letters commence, "Madam.'

Baron's Son—"The Honorable John ——." Letters commence, "Sir."

Baron's Son's Wife—"The Honorable Mrs. ——." Letters commence, "Madam."

Baron's Wife, and *Baroness* in her own right—"The Right Honorable Lady ——;" in strictness, but more commonly, "The Lady ——." Letters commence, "Madam," and refer to her as "Your Ladyship."

Baronet—"Sir John ——, Bart." Letters commence, "Sir."

Baronet's Wife—"Lady ——." Unless she has a title as the daughter of a peer, no Christian name is used. She is referred to as "Your Ladyship."

Bishop—"The Right Reverend the Lord Bishop of ——." Letters commence, "My Lord." Frequently the address is simply, "The Lord Bishop of ——." The style in formal documents is "The Right Reverend Father in God (John ——), by Divine permission, Lord Bishop of ——." Scotch bishops are addressed "The Bishop of ——," sometimes as "The Right Reverend Bishop (e.g., Henry Cotterell)," and letters commence, "Right Reverend Sir." The colonial bishops are addressed by their territorial titles, like those of England.

Bishops' Wives and Children have no titles.

Countess—"The Right Honorable the Countess of ——." Letters commence, "Madam," and refer to her as "Your Ladyship."

Duchess—"Her Grace the Duchess of ——." Letters commence, "Madam," and refer to her as "Your Grace."

Duke—"His Grace the Duke of ——." Letters commence, "My Lord Duke," and he is referred to as "Your Grace."

Duke's Daughter—"The Right Honorable Lady Mary ——," or less formally, "The Lady Mary." Letters commence "Madam," and refer to her as "Your Ladyship." If she is married to a person of inferior rank, her surname only is changed.

Duke's Eldest Son—Uses the second or some other title of his family by courtesy, and he is addressed as if he held the title by law, though in formal documents he is called "——, Esq., *commonly called* the Marquis or Earl" (as the case may be).

Duke's Younger Son—"The Right Honorable Lord John Russell," or less formally, "The Lord John R.——." "My Lord," and "Your Lordship."

Duke's Younger Son's Wife—"The Lady John ——," unless where she has a title in her own right. "Madam," and "Your Ladyship."

Earl—"The Right Honorable the Earl of ——," or less formally, "The Earl of ——." "My Lord," and "Your Lordship."

Earl's Daughter—Like Duke's Daughter (q.v.)

Earl's Eldest Son is addressed as if the title which he holds in courtesy were a title in law.

Earl's Younger Son—Like Baron's Son (q.v.).

Earl's Younger Son's Wife—Like Baron's Son's Wife, unless of superior rank to her husband.

Earl's Wife. See *Countess*.

King—"The King's Most Excellent Majesty." "Sire," and "Your Majesty;" or, in less formal notes, thus: "Mr. Pill presents his duty to Your Majesty."

Knight Bachelor—Like Baronet (q.v.), except that the word "Bart." is omitted.

Knight Bachelor's Wife—Like Baronet's Wife (q.v.).

Knight of the Garter—K.G. is added to the name or other title of the bearer.

Knight of St. Patrick—K.P. used in the same manner.

Knight of the Thistle—K.T.

Knight of the Bath—if a Knight Grand Cross, K.G.C.B.; if a Knight Commander, K.C.B.

Knight of the Bath's Wife—Like the wife of a Baronet or Knight Bachelor.

Lord Advocate (of Scotland)—"The Right Honorable Lord Advocate" by courtesy; but in official documents he is styled "Her Majesty's Advocate for Scotland." Letters ought strictly to commence, "Sir," not "My Lord," though the latter mode of address is the more usual.

Lord Lieutenant (of Ireland)—"His Excellency the Lord Lieutenant;" and letters commence in accordance with his rank in the peerage or otherwise. If a duke, he is styled "His Grace the Lord Lieutenant."

Lord Mayor—"The Right Honorable the Lord Mayor." "My Lord," and "Your Lordship." There are only three Lord Mayors—those of London, York, and Dublin.

Lord Provost—The Provost of Edinburgh is "The Right Honorable the Lord Provost;" of Glasgow, "The Honorable the Lord Provost;" of Perth and of Aberdeen, "The

Lord Provost." There are no other Lord Provosts. Perhaps the distinction in the title of the chief magistrate of the Scottish capital is traceable to his having been always a member of the Privy Council of Scotland, from at least the period of the revolution.

Lord of Session (in Scotland)—"The Honorable Lord ——." "My Lord," and "Your Lordship."

Lords of Her Majesty's Treasury—These in their collective capacity are addressed as "The Honorable the Lords Commissioners of Her Majesty's Treasury;" individually they have no title from their connection with the Treasury.

Maid of Honor—"The Honorable Miss;" and "Madam."

Marchioness—"The Most Honorable the Marchioness of ——." "Madam," and "Your Ladyship."

Marquis—"The Most Honorable the Marquis of ——," *not* "The Most Noble." Letters commence, "My Lord Marquis;" but when personally addressed, he is styled "My Lord," and "Your Lordship."

Marquis's Daughter—Like Duke's Daughter (q.v.).

Marquis's Eldest Son—Like Duke's Eldest Son (q.v.).

Marquis's Younger Son—Like Duke's Younger Son (q.v.).

Mayors—In formal documents, "The Right Worshipful the Mayor ——;" but in letters simply "The Mayor."

Members of Parliament—The letters M.P. are added to their usual address.

Officers in the Navy and Army—Their rank in the service, if above subalterns, is always prefixed to any other title they may possess, thus: "Captain the Lord John ——."

Prince—"His Royal Highness Prince ——;" or His Royal Highness the Duke of ——," when the Prince is also a Duke. In practice, the initials H.R.H. are usually substituted for the words. A letter begins "Sir," not "My Lord Duke;" and the mode of reference is "Your Royal Highness.

Princess—"Her Royal Highness the Princess ——,"or "The Duchess" (as the case may be). "Madam," and "Your Royal Highness."

Prince's Wife, though of inferior rank, like a Princess by birth.

Privy Councilor—"The Right Honorable John ——."

Privy Councilor's Wife and Children have no title.

QUEEN—"The Queen's Most Excellent Majesty." "Madam," and "Your Majesty," or, "The Lord John R—— presents his duty to your Majesty."

Viscount—"The Right Honorable Lord Viscount ——," or less formally, "The Lord Viscount." "My Lord," and "Your Lordship."

Viscountess—"The Right Honorable the Viscountess," or less formally, "The Viscountess," "Madam," and "Your Ladyship."

Viscount's Daughter, like Baron's Daughter (q.v.).

Viscount's Son, like Baron's Son (q.v.).

Viscount's Son's Wife, like Baron's Son's Wife (q.v.).

The formality of these modes of address experiences considerable modifications when employed by persons of equal rank. Between friends and relatives, they are either entirely dispensed with (except, of course, in addressing letters), or adapted to the feelings and caprices of the writers. In this, as in many other respects, we of the present generation are far less ceremonious than our fathers, and still more than our grandfathers were. In most old letters, it will be found that the titles of the writers are preserved even where there is the freest and most familiar interchange of thought and feeling; wives addressing their husbands, and husbands their wives, children their parents, and occasionally even parents their children, as "Sir," or "Madam," "My Lord," or "Your Royal Highness," as the case might be.

FORMS OF PROCEDURE. See PROCESS.

FORNARI'NA, LA, the daughter of a baker in Rome, the model of many figures by Raphael, and represented to have been his mistress. Raphael saw her washing her feet in the river, fell in love with her, and made her name immortal.

FORNEY, JOHN WEISS, b. in Penn., 1817; a printer and journalist. In 1837, he was editor of the Lancaster *Intelligencer*. In 1848, and for some years afterwards, he edited the *Pennsylvanian*, a democratic paper in Philadelphia. In 1851, he was clerk of the house of representatives (in congress), and was re-elected in 1853. About the same time he was editor of the *Union*, in Washington. When the rebellion began, he became a zealous republican, and edited the *Press* of Philadelphia, and *Chronicle*, Washington In 1861, he was clerk of the senate. At present (1880), he is the editor of *Progress*, a weekly literary paper published in Philadelphia. He is the author of *Anecdotes of Public Men; Letters on Europe;* and the *Life of Gen. W. S. Hancock*. In 1880, he returned to the support of the democratic party.

FORNICATION (*fornicatio*, from *fornix*, an arch-vault, and by metonymy, a brothel, because brothels at Rome were in cellars and vaults under ground). In most countries this crime has been brought within the pale of positive law at some period of their history, and prohibited by the imposition of penalties more or less severe; but it has always been found ultimately to be more expedient to trust to the restraints which public opinion impose on it in every community which is guided by the principles of morality and religion. In England, in 1650, during the ascendency of the Puritan

party, the repeated act of keeping a brothel, or committing F., was made felony without benefit of clergy on a second conviction. At the restoration, when the crime of hypocrisy seemed for a time to be the only one which, under the influences of a very natural reaction, men were willing to recognize, this enactment was not renewed; and though notorious and open lewdness, when carried to the extent of exciting public scandal, continued, as it had been before, an indictable offense at common law, the mere act of F. itself was abandoned "to the feeble coercion of the spiritual court, according to the rules of the canon law, a law which has treated the offense of incontinence with a great deal of tenderness and lenity, owing perhaps, to the constrained celibacy of its first compilers."—*Blackstone.* The proceedings of the spiritual court were regulated by 27 Geo. III. c. 44, which enacts that the suit must be instituted within eight months, and that it cannot be maintained at all after the marriage of the parties offending. But proceedings in the ecclesiastical courts for this offense have now fallen into entire desuetude. (Stephen's *Com.* iv. 347.) In Scotland, shortly after the reformation, F. was prohibited by what baron Hume calls "an anxious statute of James VI." (1567 c. 13), entitled "Anent the filthie vice of fornication, and punishment of the samin." This act, which was passed in the same parliament by which incest and adultery are punished with death, provides that the offender, whether male or female, shall pay for the first offense a fine of £40 Scots, and shall stand bareheaded, and fastened at the market-place for the space of two hours; for the second, shall pay a fine of 100 merks, have the head shaven, and shall be exposed in the same public manner; and for the third, pay a fine of £100, be thrice ducked in the foulest pool of the parish, and be banished the town or parish for ever. There is but one instance of this statute having been enforced by the court of justiciary, which occurs, as might be supposed, during the government of the protector in Scotland. The offense of keeping a house of notorious ill-fame and scandalizing the neighborhood, is punishable in Scotland as a police offense, though it is greatly condoned. See NUISANCE and PROSTITUTION.

FORRES, a royal burgh in the co. of Elgin or Moray, situated on a well-marked old sea-terrace and promontory, distant about 2 m. from the mouth of the river Findhorn (q.v.). Pop. '71, 3,959. It was a royal burgh in the reign of king David I. (1124–53), and was subsequently the seat of the archdeacon of Moray, who had as his prebend the church of F., dedicated to St. Laurence the martyr, and the church of Logynfythenach (now Edinkillie), dedicated to St. John the Baptist. A painting of St. Laurence holding in his hand the gridiron on which he is said to have been roasted, is preserved at Brodie house near Forres. The antiquities of the place are the remains of its castle, at the w. end of the town, now surmounted by a monument, erected to the memory of Dr. Thomson (a native of Cromarty, distinguished by his eminent medical services in the Crimean war), and the remarkable sculptured pillar—25 ft. high—sometimes called Sueno's stone, but more commonly "the Stan'in' Stane," which stands about a mile to the eastward. A monastery of black friars is said to have stood formerly on the site now occupied by Anderson's academical institution. F. lies at the foot of a curiously formed group of four gravelly hills, named the Cluny or Cleeny hills, evidently water-made, on the highest of which, the site of an old encampment, is a tower 66 ft. high, erected to the memory of Nelson in 1806. Upon one of these eminences is an excellent hydropathic establishment called Cluny hill house.

FORREST, EDWIN, 1806–72; b. Philadelphia, of Scotch and German descent. He made his first appearance on the stage, Nov. 27, 1820, as "Young Norval" in the play of *Douglas.* By diligence and close study he rose in the profession, and in 1826, at the Park theater, New York, made a decided triumph in "Othello." Thenceforward his career was one of uninterrupted success in this country and in England. While in the latter country in 1837 he married Catherine, the daughter of John Sinclair, the singer. She was afterwards divorced from him, and the trial in the case was one of the most famous in the country. His last professional engagement was in New York in 1871. He died from apoplexy after only half an hour's illness. In his will he left a large portion of the ample estate which he had amassed in his profession, to establish a home for aged and destitute actors. Forrest was essentially a melodramatic actor. His robust physique and still more robust voice made the assumption of sentimental parts almost impossible. In "Richard III.," "Lear," "Coriolanus," and, "Othello," he was conspicuously good. He was better still in "Jack Cade," "Metamora," "Spartacus," "Damon," and characters of that range. Much undeserved odium has been cast upon him as being in some degree responsible for the Astor place riot in New York. That outbreak—ostensibly in favor of F. against his great English rival Macready—was one of the episodes of the political native American movement of the period. F. was of a disposition ardent, impetuous, and frank; and his scholarship in the range of his profession was good. He gathered a splendid library, in which the Shakespearean collection was reputed the finest in the world.

FORREST, URIAH, 1756–1805; a lieut.col. in the Maryland line in the revolution, wounded at Germantown. He was a member of congress in 1786, afterwards in both houses of the state legislature, maj.gen. of militia, and clerk of the circuit court of the district of Columbia.

FORSKAL, Peter, 1736–63; b. Sweden; educated at Göttingen, he early displayed aptitude for studies in natural history, and attracted the attention of Linnæus, who presented him to Frederick V. of Denmark. That monarch gave him a professorship at Copenhagen, and also sent him with Carsten Niebuhr on an expedition to Arabia and Egypt. Seized with an attack of the plague, he died at Jerim in Arabia, leaving his friend and companion in charge of his MSS., of which the latter published, in 1775, *Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium, quæ in itin. Orient, observavit Petrus Forskal.* In the same year appeared also an account of the plants of Arabia Felix and of Lower Egypt, under the title of *Ægyptiaco-Arabica*, important as containing the first discussion of the relation of vegetation to climate.

FORST, Forsta, or Forste, a t. in Brandenburg, Prussia, circle of Sorau, on the Neisse, 44 m. s.e. of Frankfort-on-the-Oder. Its principal industries are tanning and the manufacture of woolen cloth; it has also a considerable cattle trade. Near the town are the ruins of an old castle. Forst was founded in the 13th c., and was burnt by the Hussites in 1430. From 1667 it belonged to the dukes of Sachsen-Merseburg, from 1740 to the palatinate of Saxony, and from 1815 to Prussia. Pop. '75 (including Altforst, united to it in 1874), 14,148.

FÖRSTER, Ernest Joachim, b. 1800; a German art critic and painter, brother of Frederick, the historian and poet. Ernest at first applied himself to the study of theology and philosophy, but soon devoting himself to art, entered the studio of Peter Cornelius at Munich. He was employed in painting the frescoes in the Aula at Bonn, and those of the glyptothek and the arcades at Munich; but his reputation rests chiefly on his discovery of several ancient pictures, and on his works in elucidation of the history of art. His greatest discovery was the frescoes of Avanzo, which date as far back as 1376, in the chapel of San Giorgio at Padua. Among his works are excellent guide-books to Munich, Italy, and Germany; *Studies relating to the History of Modern Art; Letters on Painting; History of German Art; Monuments of German Architecture, Sculpture, and Painting;* and a *History of Italian Art.* He has written a life of Jean Paul Richter, and edited several of his works.

FÖRSTER, Friedrich, 1791–1868; a German historian, brother of Ernest Joachim, the painter. After receiving his early education in the gymnasium at Altenburg, he studied theology at Jena, but subsequently devoted his attention for a time chiefly to archæology and the history of art. On the uprising of Prussia against France in 1813, he joined the army, where he soon attained the rank of capt. At the close of the war he was appointed professor in the school of engineering and artillery in Berlin, but on account of certain democratic writings he was dismissed from that office in 1817. He then became connected with various literary journals, and in 1830 undertook with his brother an art tour in Italy. Shortly after his return he received an appointment in the royal museum of Berlin, with the title of court councilor. Forster was the founder and secretary of the scientific art union of Berlin.

FORSTER, John, an English political and historical writer, was born at Newcastle in 1812. He was educated for the bar, but early, like so many other law-students, devoted himself to periodical writing. In this sphere of literature he displayed more than usual ability; and his political articles in the London *Examiner*, for which he commenced writing in 1834, attracted more attention than is usually bestowed on newspaper leaders. There was a vigor and point about them, coupled with a truth, consistency, and outspoken honesty, which obtained a wide renown for the paper. F. succeeded Dickens for a short time as editor of the *Daily News*, and was editor of the *Examiner* for ten years. He is the author of many admirable biographical and historical essays, and we are indebted to him for much new and valuable information tending to elucidate obscure points, and correct erroneous notions about the times and statesmen of the English commonwealth. It is to this period of history that F. has chiefly directed his studies, and no person desirous of properly understanding it, should neglect his *History of the Grand Remonstrance; Arrest of the Five Members; Sir John Eliot, a Biography;* and *Lives of the Statesmen of the Commonwealth.* His literary memoirs are also excellent. The chief are *The Life and Times of Oliver Goldsmith* (1848); *Walter Savage Landor*, 2 vols. (1868); *The Life of Charles Dickens*, 3 vols. (1871–1874); and the first volume of a *Life of Swift* (1876). F.'s style is clear, forcible, and elegant. He was appointed secretary to the commissioners in lunacy in 1856, and a commissioner in lunacy in 1861. F. died in 1876.

FORSTER, Johann Georg Adam, commonly known as George F., eldest son of Johann Reinhold Forster (q.v.), a German traveler and naturalist, was born at Nassenhuben, near Dantzig, in 1754, and died at Paris in 1794. When only 17 years of age, he accompanied his father in capt. Cook's second voyage; and shortly after his return, he published, with the assistance of his father, an account of the expedition. His book, which does not differ materially in its facts from Cook's narrative, was well received by the public, and was translated into French, German, Swedish, and other languages. Humboldt speaks of this work and of its author, "my celebrated teacher and friend, George Forster," in the highest terms in the *Cosmos* (see vol. ii. p. 437, Bohn's ed.). F. having returned to the continent, was made professor of natural history at Cassel, and

afterwards at Wilna. Having there no access to books, in 1788 he gladly accepted the office of librarian to the elector of Mayence. After Mayence was taken by the French in 1792, F., who had become an ardent republican, was sent as a deputy to Paris, to request the incorporation of Mayence with the French republic, While he was in Paris on this mission, the Prussians retook Mayence, and F. lost all his property, including his books and manuscripts. He then writes to a friend: "If I could only scrape together £400, I would learn Persian and Arabic, and go overland to India to gather new experience," but about this time he seems to have been suffering from rheumatic gout, which gradually increased in severity, and which terminated his life on the 12th of Jan., 1794. Besides numerous translations, and the account of capt. Cook's voyage, his most important works are *Kleine Schriften, ein Beitrag zur Länder und Völkerkunde, Naturgeschichte und Philosophie des Lebens* (6 vols., Berlin, 1789–97), and *Ansichten vom Niederrhein, Brabant, Flandern, Holland, England, und Frankreich* (3 vols., Berlin, 1791–94). His widow, the daughter of Heine, but perhaps more widely known as Therese Huber, published a collection of his letters, in 2 vols., in 1828–29; and a complete edition of his works, in 9 vols., was published by his daughter and Gervinus, in 1843.

FORSTER, JOHANN REINHOLD, a German traveler and naturalist, was born in Dirschau, in Prussia, in 1729, and died at Halle in 1798. He was educated at Halle and Dantzig for the clerical profession, and in 1753 became pastor at Nassenhuben, near Dantzig; but he seems to have devoted most of his time to the study of mathematics, natural philosophy, natural history, and geography. In 1765, he accepted an offer made to him by the Russian government, to inspect and report upon the new colonies founded on the banks of the Volga; and the matter of his report is said to have been so good as to have given to the empress Catharine suggestions for her great code of laws. His irritable temper soon involved him in difficulties with the Russian government; and in the following year he repaired to England, where the exertions of some of his scientific friends in London soon procured for him the office of teacher of natural history, and of the French and German languages, at an educational institution for dissenting clergymen at Warrington, in Lancashire. He retained this post until 1772, when he received, through the influence of Mr. Banks, the offer of naturalist to capt. Cook's second expedition to the south seas. In the course of the voyage, his temper seems to have frequently brought him into unpleasant collision with the other officers; and after the return of capt. Cook's vessels in July, 1774, a controversy arose between F. and lord Sandwich on the question as to who should write the narrative of the voyage. It was settled that F. should write the philosophical, and Cook the nautical parts of the work; but further difficulties arose, and Cook's journal appeared alone. In 1776, in association with his son, he published a work (in Latin) on the botany of the expedition; and in 1778 his *Observations faites dans un Voyage autour du Monde sur la Géographie Physique, l'Histoire Naturelle, et la Philosophie Morale.* In the latter year, he returned to Germany, and was soon afterwards made professor of natural history and mineralogy at Halle, where he remained until his death. Besides the above works, he published *De Bysso Antiquorum*, 1775; *Zoologia Indica*, 1781; *Geschichte der Entdeckungen und Schiff-fahrten im Norden*, 1784 (Eng. and French trans.), etc.

FORSTER, WILLIAM, 1784–1854; b. England; married a sister of Thomas Powell Buxton; became a preacher in the society of Friends, and labored as such in the United States, England, and France. In 1846, he was commissioned by the Quaker yearly meeting in London to present an address on slavery and the slave trade to rulers of Christian nations, in the prosecution of which he had interviews with nearly all the monarchs of Europe, with the president of the United States and a number of the governors of southern states.

FORSTER, The Right Hon. WILLIAM EDWARD, M.P., son of William Forster, who was for more than 50 years a minister of the society of Friends, and died on an anti-slavery mission in Tennessee, was born at Bradpole, Dorset, on July 11, 1818. He was educated at the Friends' school, Tottenham, and became a worsted manufacturer at Bradford. In 1859, he contested Leeds unsuccessfully in the liberal interest, and in 1861 was elected for Bradford, which he continues to represent. He filled the post of under-secretary for the colonies from Nov., 1865, till July, 1866, and was vice-president of the committee of council on education, and fourth charity commissioner, from 1868 to 1874. Mr. F. acquired a great reputation from the admirable manner in which he piloted through the house of commons the education bill of 1870, and also the ballot bill of 1871. He is an able and fluent speaker.

FORSYTH, a co. in n. Georgia on the Chattahoochee river: 250 sq.m.; pop. '70, 7,983—1121 colored. The surface is hilly, and in some places mountainous. The soil is fertile. There are valuable minerals, such as copper, silver, and gold. Co. seat, Cumming.

FORSYTH, a co. in n.w. North Carolina; on the Yadkin river; 350 sq.m.; pop. '70, 13,050—2,334 colored. The surface is rough, and the soil fertile. Productions, corn, wheat, oats, potatoes, etc. Co. seat, Winston.

FORSYTH, JOHN, 1781–1841; b. Va.; graduated at Princeton, and admitted to the bar at Augusta, Ga., in 1802. In 1808, he was state attorney general; in 1812, member of congress, and in 1818, U. S. senator. In 1823, he was minister to Spain, and the negotiator of the treaty for the annexation of Florida to the United States. He was again in congress both as representative and senator, and in 1827 was governor of Georgia. Under Jackson and Van Buren he was secretary of state.

FORSY'THIA, a genus of shrubs of the order *oleaceæ*. The *F. viridissima* and *F. suspensa*, small Chinese shrubs, now commonly cultivated, are hardy, and noticeable for their yellow flowers, which appear before the leaves in the spring. The name is in honor of a distinguished Scotch gardener, William Forsyth.

FORT, a term of peculiar meaning in British N. America, applied to a trading-post in the wilderness with reference to its indispensable defenses, however slight, against the surrounding barbarism. It has thus been often employed to designate merely a palisaded log-hut, the central oasis of civilization in a desert larger, it may be, than Scotland.

FORT, FORTRESS (from Lat. *fortis*, strong), a stronghold, made secure by walls, and generally further protected by a ditch and parapet. For the construction of forts, see FORTIFICATION.

FORT ADJUTANT, an officer holding an appointment in a fortress—where the garrison is often composed of drafts from different corps—analogous to that of adjutant in a regiment. He is responsible to the commandant for the internal discipline, and the appropriation of the necessary duties to particular corps. Fort adjutants are staff-officers, and so receive a certain allowance per day in addition to their ordinary regimental pay.

FORTALEZA, or VILLA DO FORTE (CEARÁ, *ante*), a t. of Brazil in the province and on the river Ceará, 3° 42′ s., and 38° 30′ west. There is an old and a new town with regular and well-paved streets. There is a good export trade in coffee, cotton, and sugar. Pop. about 20,000.

FORT ANN, a village in Washington co., N. Y., on the Champlain canal, and the Rensselaer and Saratoga railroad; 67 m. n. of Albany; pop. of township '75, 3,448. There is an English fort here built in 1709, taken from the Americans in 1780. The village is on the shore of lake George, and is a place of considerable business as well as a resort for travelers.

FORT ATKINSON, a village in Jefferson co., Wis., on the Rock river and the Chicago and Northwestern railroad; pop. 2,010. It contains a number of manufactories, and has two weekly newspapers.

FORT AUGUSTUS, a village at the s. end of Loch Ness, 29 m. s.w. of Inverness. A fort, intended to overawe the Highlands, and having accommodation for 200 to 300 men, was built here soon after the rebellion of 1715, on a small eminence. It was taken by the rebels in 1745, and became the head-quarters of the duke of Cumberland after Culloden. In 1867, the fort and crown property adjoining were sold to lord Lovat, who has since converted it into a Benedictine educational institute.

FORT BEND, a co. in s.e. Texas on the Brazos river, traversed by the Galveston, Harrisburg, and San Antonio railroad; 920 sq.m.; pop. '70, 7,114—5,510 colored. The surface is level, with prairies and live-oak forests; soil, fertile. Cattle-raising is the chief occupation. Co. seat, Richmond.

FORT DODGE, a city in Webster co., Iowa, on the Des Moines river, at the junction of the Iowa division of the Illinois Central with the Des Moines and Fort Dodge railroad; pop. '75, 3,537. The river affords power for a large number of manufactories. There are a court-house, seven or eight churches, and a number of public schools. In the vicinity are quarries of coal, building-stone, and gypsum.

FORT DONELSON and FORT HENRY, the first on the Tennessee and the last on the Cumberland river, near the line between Tennessee and Kentucky, about 12 m. apart. The works were built in 1861 by the confederates, and strongly manned. Early in 1862 the union army undertook their capture. Feb. 2, a naval force, followed by land troops, left Cairo, arriving the next morning before Fort Henry, which was defended by 3,000 men commanded by gen. Tilghman. On the 6th a combined attack was made, the naval force commanded by commodore A. H. Foote, and the land force by brig.gen. U. S. Grant. The fort was taken by the naval forces in an hour, some time before the land troops arrived. On the 12th, Grant moved upon Fort Donelson, which had received large reinforcements, including nearly all the garrison of Fort Henry, and the commands of gens. Pillow, Buckner, and Floyd. On the 13th, Grant began a cannonade. The next day an attack was made by the fleet, but within two hours every gun-boat was disabled, 54 men were killed, and the fleet was compelled to withdraw. The confederates, hoping to secure a retreat towards Nashville, attempted a surprise on the morning of the 15th. They were promptly met, and an indecisive action continued until 3 P.M. At that hour Grant ordered a general advance, drove the confederates within their own lines, and gained a position within their works. About 2,000 on each side were killed or wounded in the course of the day. Grant prepared for a general

assault the next morning, but the confederate leaders concluded to surrender. During the night, Floyd with about 1500 men, Forrest with a few hundred, and Pillow and his staff, escaped, leaving Buckner in command. On the morning of the 16th, Buckner sent to Grant asking the appointment of commissioners to settle upon the terms of capitulation and for an armstice until the next day at noon. Grant returned on the instant the now famous reply: "No terms other than unconditional surrender can be accepted. I propose to move immediately upon your works." Buckner had no alternative, and at once surrendered the fort with 10.000 men, 48 guns, and a great quantity of ammunition. The terms of Grant's answer were universally recognized by the loyal public as a vivid expression of their feelings; and from the similarity of the initial letters of his name (Ulysses Simpson) he came to be called "Unconditional Surrender Grant."

FORT DUQUESNE. See PITTSBURG.

FORTÉ, in music, the Italian term for loud; *fortissimo*, as loud as possible.

FORT EDWARD, a village and township in Washington co., N. Y., on the Hudson river, the Champlain canal, and the Rensselaer and Saratoga railroad; pop. of village '75, 8,492. A dam across the Hudson here affords great water-power. The village contains several manufactories, has two newspapers, and it is the seat of the Fort Edward collegiate institute, an institution free to both sexes for higher education. There are some remains of a fort built in 1709, and of another built in 1755. It was a place of much importance in the French and Indian war, and was repeatedly occupied by opposing forces in the revolution. The name was given in honor of Edward, duke of York.

FORTESCUE, CHICHESTER SAMUEL PARKINSON, b. England, 1823; graduated at Oxford. He has been a member of parliament for Lowth since 1847, acting with the liberals. He has been a lord of the treasury, under-secretary of state for the colonies, chief secretary of Ireland, privy councilor, member of Mr. Gladstone's cabinet in 1868, and in 1871 president of the board of trade.

FORTESCUE, Sir JOHN, an eminent judge and writer on English law, descended from a Devonshire family, was the son of sir Henry Fortescue, lord chief-justice of Ireland, and was born sometime in the reign of Henry VI. Educated at Exeter college, Oxford, he was called to the bar at Lincoln's inn, and in 1441 was made sergeant-at-law. The following year, he was appointed lord chief-justice of the court of king's bench. In the struggle for the crown between the houses of York and Lancaster, he steadily adhered to the latter, and is supposed to have been for a time lord high chancellor of England. Lord Campbell, in his *Lives of the Lord Chancellors* (vol. i. p. 367), under date Feb. 17, 1461, says: "If sir John Fortescue ever was *de facto* chancellor, and in the exercise of the duties of the office, it must have been now, after the second battle of St. Albans, and at the very conclusion of the reign of Henry VI." In Mar. of that year, he fought at the battle of Towton for that monarch, and was attainted by the parliament under Edward IV. He accompanied the queen Margaret of Anjou, and her young son, prince Edward, on their flight into Scotland, and while there wrote a treatise in support of the claim of the house of Lancaster to the English crown. In 1463, he embarked with the queen and her son for Holland, where he remained for several years, intrusted with the education of the young prince. During his exile, he wrote his celebrated work, *De Laudibus Legum Angliæ*, for the instruction of his royal pupil. In the introduction, and throughout the dialogue, he designates himself "Cancellarius." It was when he was in Scotland that the title of chancellor of England is said by some to have been conferred upon him by the dethroned monarch. He probably had the titular office of chancellor *in partibus* during his exile, but never exercised the functions in England. In 1471, he returned with queen Margaret and her son; but on the final defeat of the Lancastrian party at the battle of Tewkesbury, where he is said to have been taken prisoner, finding that parliament and the nation had recognized the title of Edward IV., he submitted to that monarch, and, as a condition of his pardon, wrote a treatise in favor of the claim of the house of York. He was allowed to retire to his seat of Ebrington, in Gloucestershire, where he died in his 90th year. His male representative was, in 1789, created earl Fortescue and viscount Ebrington in the peerage of Great Britain.

FORTESCUE, Sir JOHN (*ante*), an English lawyer in the time of Henry VI., descended from an ancient family in Devonshire. He was educated at Exeter college, Oxford. During the reign of Henry VI. he was three times appointed one of the governors of Lincoln's Inn. In 1441, he was a king's sergeant at law, and in the following year chief-justice of the king's bench. As a judge, Fortescue is highly commended for his wisdom, gravity, and uprightness; and he seems to have enjoyed great favor with the king, who is said to have given him substantial proofs of esteem and regard. He held his office during the remainder of the reign of Henry VI., to whom he steadily adhered; and having faithfully served that unfortunate monarch in all his troubles, he was attainted of treason in the first parliament of Edward IV. When Henry subsequently fled into Scotland, he is supposed to have appointed Fortescue, who appears to have accompanied him in his flight, chancellor of England. In 1463, Fortescue accompanied queen Margaret and her court in their exile on the continent, and returned with them afterwards to England. During their wanderings abroad, the chancellor wrote, for the instruction of the young prince Edward, his celebrated work, *De laudi-*

bus legum Angliæ, a masterly eulogy of the laws of England. On the defeat of the Lancastrian party he made his submission to Edward IV., from whom he received a general pardon dated Westminster, Oct. 13, 1471. He died at an advanced age, but the date has not been ascertained. A valuable and learned work by F. written in English, was published in 1714, discussing the difference between an absolute and limited monarchy, as regards the English constitution. Of Fortescue's other writings, which were numerous, the most important are: *Genealogy of the House of Lancaster; Genealogiæ Regum Scotiæ; A Dialogue between Understanding and Faith;* and *A Prayer Book which savors much of the Times we live in.*

FORT FISHER, an earthwork in North Carolina, on the peninsula between the ocean and Cape Fear river, defending the entrance to the port of Wilmington. In the last year of the war of the rebellion this was the only port open to the confederates, and it became a matter of importance to the unionists to close it. To effect this purpose, a formidable fleet left Hampton roads Dec. 13, 1864, and arrived off Federal point on the 15th. On the 23d, gen. Benjamin F. Butler, who was chief in command, prepared to attack, and did so the next day. One of his reliances was on a hulk laden with 215 tons of powder, to be exploded as near to the fort as it could be brought. This hulk was brought to a point 600 ft. from the shore and about 3,000 ft. from the fort, and fired. The explosion did no appreciable damage to the fort. The fleet then opened fire, and in a little over an hour the guns of the fort were silenced. On the 25th the bombardment was renewed, and under cover of it a reconnoitering force went within 150 yards of the fort, but an assault was deemed unadvisable, and the troops were re-embarked, and returned to James river. The fleet, however, remained, and Jan. 2d and 3d, 1865, 8,000 men were assembled at Bermuda Hundred, under command of gen. A. H. Terry. Embarking on the 4th and 5th, they landed on the 13th under cover of the fire of the vessels. There was hard fighting on the 14th and 15th, resulting in the capture of the fort, with over 2,000 prisoners and 169 guns. The union loss was 110 killed and 536 wounded. The confederates then blew up their remaining works, and the control of the mouth of Cape Fear river passed into union hands.

FORT GAINES, the seat of justice of Clay co., Ga., on the Chattahoochee river and a branch of the Southwestern railroad, at the head of steamboat navigation on the river; pop. '70, 758. It is an important shipping place for cotton.

FORT GARRY, a Hudson's Bay Company's station, beside which has sprung up the thriving town of WINNIPEG, capital of the province of Manitoba, in the Dominion of Canada. Winnipeg is situated at the junction of the Assiniboine and Red rivers. Pop. in 1871, about 350; and in 1878, 8,500.

FORT GEORGE, a fortification in the n.e. of Inverness-shire, on a low sandy projection into the Moray firth, here only 1 m. broad. It is the most complete fort in the kingdom, and was built, at a cost of £160,000, after the rebellion of 1745, to keep the Highlanders in subjection. It covers 12 acres, and can accommodate 2,000 men. It is an irregular polygon, with 6 bastions, and upwards of 70 guns. It is defended by a ditch, covert-way, a glacis, two lunettes, and a ravelin. It has casemated curtains, 27 bomb-proof rooms, bomb-proof magazines, and is supplied with water from 8 pump-wells. It is, however, only secure from attack by sea.

FORT GEORGE (INDIA). See MADRAS.

FORTH, a river of Scotland, rises in the n.w. of Stirlingshire, in the mountains between Loch Katrine and Loch Lomond, from two main branches, the Duchray, 16 m. long, from the e. side of Ben Lomond, and the Avendhu, 12 m. long, flowing through Lochs Chon, Dhu, and Ard. These streams unite at Aberfoyle, and issue from the mountains. The F. then runs e. and s.e. along the borders of Perth and Stirling shires, with numerous windings, in a wide valley abounding in picturesque scenery. It passes Stirling, and a little above Alloa it widens out into the firth of Forth. The F. is only 30 m. long in a straight line from its source to the mouth of the Devon; but, owing to its sinuosities, its real course is more than twice that length. It is navigable for vessels of 100 tons to Stirling. Its chief tributaries are the Teith, the Allan, and the Devon. The upper parts of the F. and Teith traverse some of the most romantic lake and mountain scenery in Scotland.

FORTH, FIRTH OF, an arm of the sea, or the estuary of the river Forth, lies between the counties of Clackmannan, Perth, and Fife on the n.; and those of Stirling, Linlithgow, Edinburgh, and Haddington on the south. It first extends 6 m. s.e. from where the Devon joins the Forth; then, with an average breadth of 2¼ m., it runs 10 m. to Queensferry; and finally, it extends 36 m. n.e., gradually expanding in width to 15 m. between Fife-ness and Tantallon castle on the coast of Haddingtonshire. It waters are from 7 to 30 fathoms deep, and encircle the isle of May, Bass Rock, Inchkeith, Inchcolm, Cramond isle. etc. On the coast, are many fine harbors. St. Margaret's Hope, above Queensferry, is one of the safest roadsteads in the kingdom. The chief rivers which fall into the firth are the Forth, Carron, Avon, Almond, Esk, and Leven. The counties along its shore are the most fertile and best cultivated in Scotland, and include the maritime towns of North Berwick, Musselburgh, Portobello, Leith, Queensferry, Grangemouth, Culross, Burntisland, Kirkcaldy, etc.

FORTHCOMING, in the law of Scotland, is an action by which an arrestment is made available to the arrester. The arrestment secures the goods or debts in the hands of the creditor or holder; by the F. the arrestee and common debtor are called before the judge to hear sentence given, ordering the debt to be paid, or the effects to be delivered up to the arresting creditor. (Bell's *Law Dictionary.*)

FORT HOWARD, a city in Brown co., Wis., on Fox river a mile from the mouth, and on the Chicago and Northwestern railroad opposite the city of Green Bay; pop. 3,610. There are several manufactories, but lumber is the principal article of trade.

FORTIFICATION, a term derived through the Italian from the Latin *fortis* and *facere*, means literally the "making strong" of any place whatever, be it a town, an arsenal, a camp, a mere house, or the extended position of an army occupying a tract of country, a province, or even a kingdom. In effect, the term is limited to strengthening by means of walls, ditches, or other stationary obstructions, aided more or less by artillery, which may impede hostile advance.

F. cannot pretend to render strongholds impregnable, for no works, however skillfully devised, will withstand the continued fire of well-directed artillery, backed by energy and discretion on the part of assailants: its aim is to enable a beleaguered garrison to hold out, without losing ground, until it can be relieved by the advance of allies operating in the field. In fortifying a place, the engineer usually proceeds upon some defined system of entourage; but if he hope for success, his science must be sufficiently elastic to adapt itself to all the natural features of the locality; and from this it follows that a system perfect in theory, and of universal application, will in practice have to undergo modifications, differing in almost every instance.

The origin of the art is involved in an obscurity which history need not hope to penetrate. The earliest records of all nations speak of walled cities and forts.

The prime element of all F. is the parapet (from Italian *para*, before; *petto*, the breast), which may be a wooden stockade, a wall of masonry, or a mound of earth, and is intended to give more or less cover to the defender from the projectiles of his adversary, while he is still able to use his own weapons against the latter. The simplest form of parapet being the mound of earth, the ground adjoining it would probably be dug up for its formation, and from this would almost unconsciously ensue the ditch, as an additional means of separating the assailant and the assailed. Starting, then, from this parapet and ditch or fosse, as the elementary forms of defense, it will be well, before proceeding to describe the ancient and modern systems, to give concise practical definitions of the parts, adjuncts, and technical names of a fortification.

The first duty of a defender is to prevent, as far as possible, the enemy's near approach to any of his works. In developed systems, this is sought to be done by bastions, etc. (of which hereafter), which stand out at angles to the general line, so as to afford a fire commanding all parts. But as cases occasionally happen of troops, defended by a mere straight parapet and ditch, having to withstand the advance of the enemy, it is necessary to adopt every measure which can obstruct his path, harass his advance, and, if possible, aid in cutting off his retreat in the event of failure.

Abattis (q.v.) are among the simplest obstacles to be improvised, consisting of trees cut down, shorn of their leaves and smaller twigs, having their branches pointed, and then laid close together, in one or more lines parallel to the works, branches outward, and trunks imbedded or pinned down in the earth. Accoutred troops must remove these before they can pass, and the operation of removal under fire from the besieged is a very serious one indeed.

Chevaux-de-frise (q.v. for derivation) are pointed iron or wooden rods fixed crosswise in a wooden beam, and until removed offering a complete obstacle to progress. They are very useful in a breach or other unclosed portion of a work, and are now made in pieces, so as to be portable, and yet ready for immediate putting together. A cheval-de-frise is usually 12 ft. long, with a beam 9 in. square.

Chausse-trapes, or *Caltrops* (q.v.), give serious annoyance to troops advancing, and are especially dangerous in cases of night-attack. Their use was, however, more general formerly than it is now.

Trous-de-loup (wolf-traps), which are deep holes dug, and armed at the bottom with spikes, young trees cut down and their stumps pointed, inverted harrows, broken sword-blades, bayonets, or any similar annoyances, are resorted to as expedients to gain time, and thereby insure a more deadly fire on the assailants. They are frequently constructed in the glacis of a work.

Fraises and Stockades represent another form of additional defense, and are stout posts driven horizontally or perpendicularly into the earth, in long close rows. The stockade forms likewise, at times, a good substitute for the parapet itself, particularly when the direct fire of artillery is unlikely to be brought against it, as in warfare with barbarous tribes, or in a work at the very crest of a steep hill. In this case it is usually constructed of two rows of strong palisades firmly imbedded in the ground: the outer nearly a foot square, planted with three-inch intervals between; the second about six inches in diameter, closing these spaces behind. Every second small palisade is cut short a few inches, so as to leave a loophole for musketry-fire.

CONSTRUCTION OF THE PARAPET.—The object of the parapet being to defend, or

defilade a certain portion of ground behind it, its height must be calculated so that missiles passing across its crest shall fail to strike the troops mustered behind. The minimum width defiladed to allow of safe communication for troops behind, and actually defending, is 30 ft.; but if the men have to be drawn up in line, not less than 90 ft. will suffice. To ascertain the height of parapet necessary in any case, three points are selected: first, the place at which the parapet is to be constructed; second, the most elevated spot accessible to the enemy and within range; third, a point removed from the parapet at a distance sufficient to protect the troops. If, now, a line be drawn connecting points 6 ft. over the second and third positions, and a perpendicular be erected at the site of the parapet, the intersection will give the height of the parapet.

From this, the disadvantage will be apparent of constructing a parapet within range of higher ground, as for every extra foot of elevation in the commanding rise a proportionate addition must be made to the height of the parapet. In practice, the ordinary parapet for a level is 8 ft. high, which allows for the depressed trajectory of a spending ball. See PROJECTILES. If the parapet be raised on ground above the attacking position, it may be lowered, according to the angle, to about 6 ft. 6 in., the height necessary for a man standing up to be thoroughly protected. On the other hand, if the position be lower than the point occupied by the assailant, the parapet must be raised; as 12 ft. forms the limit to which a parapet can conveniently be thrown up, further height necessary for protection is obtained by sinking the ground to be defiladed before the parapet's base. In measuring for these heights, the instruments used are *boning-rods*, which are fixed in the ground at the point favorable to the enemy and at the limit of the ground to be protected by the parapet, with the normal height of a man marked on them; a third rod, at the place where the parapet is to be erected, is then marked at the point where the line of sight between the normal points on the two others intersects it, and so shows the height of the parapet.

The foregoing parapet has been provided only as a straight breastwork, deriving its safety solely from its own fire in a direct line upon the besiegers; but in practice such a rampart would be exposed to the disadvantage of holding but little command over the *scarp* or *escarp* (part cut away) at its foot; so that, if approached under cover, an enemy could readily lodge himself therein. To guard against this, a work is *flanked*, so that the fire of one part shall take in flank an enemy advancing against another part. In a flanked defense of this sort, the angles which project towards the country are technically termed *salient angles;* while those which extend inwards are called *re-entering angles*. The flanked parapet has often, likewise, the power of defilading larger spaces than the simple line of parapet, since the salient angles can, perhaps, be brought on elevated ground; while the re-entering angles, though with less elevation, may in some degree compensate that defect by greater distance from the front. A disadvantage of flanked defenses is, that the hostile fire crosses the parapet at a less angle than in the straight line, and may, therefore, be more deadly; indeed, the object of the assailant will always be to obtain an enfilade fire *along* one or more parapets of the defense. To avoid this, the engineer who constructs the works must ascertain minutely the elevation of the surrounding points, and make his salients at such angles that the prolongation of his parapets towards the enemy shall always fall on low ground, whence no command can be obtained.

Now, where the salient angle becomes somewhat acute, and there is an enemy on both fronts, the soldiers defending the right parapet, and standing on its banquette, would be exposed to a *reverse* or back fire from the enemy in front of the left parapet, beyond the defilading of which they would doubtless be. As a remedy, an internal parapet, called a *traverse*, or, from its duty, a *parados*, is raised between the parapets of the salient, its height being determined on precisely the same principles as were made use of in regard to the original parapets.

Where both the faces of the salient are unavoidably so placed as to be enfiladed, a small work, called a *bonnet*, is constructed at the angle, which consists in the parapet being so raised up to an extra height of 12 ft. if necessary, and at the same time widened, that the banquette shall be defiladed. If a height of 12 ft. is insufficient to defilade the whole length of the banquette, traversing parapets must be raised at right angles to the face of the work, and within it, at such distances that the whole may be safe: of course, the height of the bonnet and of the traverses must be decided on rules analogous to those explained. The increased height of the parapet of the bonnet renders it necessary to have two or more banquettes at that portion of the work, with steps to aid the ascent.

In inclosed works—i.e., in works entirely surrounded by parapets—the position of the parados is of vital importance; and they have often to be devised with great ingenuity, so as to protect the defenders from reverse fire in any direction, and at the same time not to prevent necessary communication between different portions of the fortress.

Relief means the height of any point in a work above the plane of construction, which may be the line of sight or the bottom of the ditch. In the latter case, the relief of the parapet is an important item in estimating the resisting power of a work, as it represents the vertical equivalent of the obstacle which will be offered to a foe.

When the relief of the parapet's crest has been determined, its thickness becomes

the next consideration. The dimensions are laid down on the ground, and depend, first, on the angle at which the material to be used will pile; and then, on the nature of the missiles against which the parapet is to afford protection. For example, an earth-work of from 3 to 4 ft. suffices to resist musketry; a thickness of 18 ft. is impervious to the 24-pounder; while larger guns can pound through even more solid obstructions.

For convenient firing the banquette should be 4 ft. 3 in. below the apex: its width 3 ft., if for a single line of soldiers; 4 ft. 6 in. for a double rank; its slope should be one in twelve, that water may run freely off. The base of the slope, up which the men mount to the banquette, should be twice its height, and cut into steps with inclined sides, to allow of easy ascent; and where the height is considerable, a supplemental banquette (on which relieving-men can, if necessary, reload), is desirable. The interior slope of the parapet should be one in four; the exterior slope, or *plongée*, intended for the direction of the guns on an assailant, one in six, a deviation being permitted between one in nine and one in four; but the crest being more liable to destruction as the slope is augmented, it is best to keep it as small as circumstances will allow; one in six is the ordinary slope in English F., the angle of the interior slope being constant. In some continental services, however, the angle between the top and inside of the parapet is kept constant at 100°, by increasing the deviation of the interior slope of the parapet from the perpendicular as the plunge of the exterior is greater. The flatter, however, the crest of the parapet is the better, as sand-bags are in certain cases ranged on it to form cover for the men, while they fire through loopholes left in this additional defense. Earth of medium tenacity maintains its position properly when sloped at an angle of 45°; and this is the greatest angle which can be counted on for the outer slope of the parapet. The scarp and counterscarp of the ditch need not have so great an incline, as the ground in which they are cut has usually had time, and the footsteps of ages, to consolidate it. In such cases, the base of the triangle is frequently made equal to half the perpendicular. Cases, of course, occur in which steeper banks are considered indispensable; and then, to prevent slips, the earth must have a coating to keep it up, which may be of fascines, hurdles, planks, or sand-bags, for temporary works, or those constructed in the midst of action; while the most solid masonry performs the same function in fortresses of a more permanent nature. This outer coating is denominated a *revêtement.*

A *glacis* is formed during the excavation of the ditch, having for its object the bringing of an advancing enemy into the best line of fire from the parapet. The base and perpendicular of its interior slope should be equal; the slope of the outer face should be one in twelve, unless the slope of the ground render some different angle desirable. An advanced glacis is sometimes adopted, in order that the enemy may the sooner be brought under fire. It is absolutely necessary that the crest of the parapet should be 5½ ft. higher than the crest of the glacis, as, otherwise, an assailant having reached the latter, would be able to pour a musketry-fire over the former into the work. No part of any glacis, whether near or advanced, should be more than 2 ft. below the line of fire from the parapet—i.e., the line joining the crests of the parapet and glacis continued; if more depth be allowed, the enemy may advance in a crouching posture, without being liable to be hit. Advanced glacis are usually made of earth thrown up in prolonging beneath the ground the plane of the preceding glacis. They may be defended entirely from the parapet, in which case palisades or abattis are often fixed to delay the advancing enemy when at the point of greatest exposure. On the other hand, these advanced glacis are occasionally defended as a series of advanced intrenchments, and only abandoned, one by one, as the defenders are driven in towards their main work.

The dimensions of the ditch depend in some measure on the amount of earth required for the parapet and glacis; but in addition to being the mine whence the materials for the latter works are drawn, the ditch must also oppose a considerable obstacle to any hostile advance. To do this effectually, the minimum width across the top is 18 ft.; its depth need only be limited by the trouble of raising the earth; but in practice 12 ft. is found the greatest which can be conveniently arrived at. Having ascertained the profile of the parapet, with its banquette or banquettes, bonnets, traverses, glacis, etc., it becomes a mere matter of mensuration to compute the area of a section, to multiply it by the length, and so to obtain the cubic feet of earth required. With the length of the ditch known, a very simple calculation then exhibits its width and depth—a small allowance being made for the fact that the earth, dug out from the ditch, where it has probably been long compressed, will occupy somewhat more space when thrown up, and broken into clods, for forming the parapet.

The *scarp*, or inner face of the ditch, is most difficult of ascent by the assailant, when in a continuous line with the parapet; but sometimes it would be dangerous to construct the work with this continuity, as damage to the scarp would jeopardize the stability of the parapet. In these cases a narrow step, called a *berm* (q.v.) of from 2 to 4 ft., is made to intervene between the foot of the parapet and top of the scarp: as a precaution, it is covered with all possible obstacles to any lodgment being effected on it by the enemy. When a berm is employed, greater steepness is usually given to the scarp.

The *counterscarp*, or outer sloping side of the ditch, should be somewhat steeper than the scarp. The bottom of the ditch should slope from both sides towards the center, to

carry off the water; and obstacles should be scattered about to prevent an enemy from forming his troops in the ditch.

EARTHWORKS IN FIELD FORTIFICATION.—As the most readily constructed, earthworks naturally recommend themselves to the engineer, who, in the field, is called upon to defend the position of an army against sudden attack. Their utility has been shown in their employment from the earliest times; and modern experience tends to prove that earth-parapets are of all fortifications among the most difficult to overcome. An army maneuvering before a superior force, can scarcely hope to avoid battle being thrust upon it, unless, strengthened by fieldworks, it be rendered more nearly equal to the adversary. Napoleon, Marlborough, Eugène, Wellington, have given their names as witnesses to the indispensability of such works. The Russian parapets at Borodino made the French victory so sanguinary a triumph that it was useless to the victors. A few redoubts at Pultowa saved Peter the great from total defeat by his formidable Swedish rival. The world-famed lines of Torres Vedras enabled Wellington with 50,000 troops, half of whom were untried Portuguese, to withstand for five months, and ultimately to drive back, the hitherto victorious army of 70,000 French, under such commanders as Masséna, Ney, and Junot. The earthworks surrounding Sevastopol partook greatly of the nature of fieldworks for the protection of a large army, and history will not forget to recount the resistance they offered for almost a year to the best troops of the civilized world.

For a line, whether of earth or masonry, to be efficient, it must combine artillery fire with that of musketry. The guns will generally be so placed as to command some specific line of approach, such as a ravine, a line of abattis, or some portion of the glacis. They should themselves be as little exposed as possible, nor should the gunners be uncovered more than is absolutely requisite. To effect this, the gun is generally made to fire through an *embrasure* (q.v.) in the parapet, instead of over the latter. The embrasure is a cutting through the solid parapet, 20 in. wide at its inner extremity, and outwards half as much as the width of the parapet. In cases where it is necessary, for proper command, that the line of fire should not be lower than the top of the parapet, the embrasure is made through an additional parapet—raised, as in the previous case of the bonnet, above the original one. The bottom of the embrasure is called the *sole*, and slopes downward sufficiently to allow of a certain depression being given to the gun. The remainder of a parapet below the sole is the *genouillère* (from *genou*, a knee), and in field F. should be 8½ ft. high; the portion between two embrasures is the *merlin* (Ital. *merlone*, battlement); and an embrasure need not cut the parapet perpendicularly, an angle being admissible, when an oblique fire is necessary. When, however, the obliquity would exceed 70°, it is usual, in order that the thickness of the parapet should not be too much diminished, to form a projecting angle in it, through which the embrasure is cut. The sides of the embrasures are *cheeks*, and require revêting.

A *barbette* is a platform raised behind a parapet, higher than the general interior, with a view to guns being fired from it over the parapet.

There are certain fixed rules in all F., such as:—1. The length of lines must never exceed musketry range, or the flanking-works would become ineffective for their object. 2. The angles of defense should be about right angles. 3. Salient angles should be as obtuse as possible. 4. Ditches should have the best possible flanking. 5. The relief of the flanking-works must be determined by the length of the lines of defense. 6. The value of almost every detached work depends on the support it can give to or receive from an army or other work or works. 7. The reduction of every fortified work is merely a question of time; and a work fairly surrounded is sure to fall, unless relieved from without.

Fieldworks, which, it must be borne in mind, are intended merely to support or strengthen an army, may either have a complete circuit of parapets, or may be open at the gorge in the rear. The latter are, of course, the simplest; but they are only available in positions which the enemy cannot turn, or where protected by the sweeping fire of other works behind. Of this class the *redan*, a mere salient angle, is the simplest and the representative form. Of the closed forts, there are *redoubts*, usually square; *star-forts*, now considered objectionable; bastioned forts, which flank their own ditches almost perfectly, while scarcely susceptible of being flanked themselves.

Continued lines are simple parapets, either connecting fortified posts, or covering the front or flank of an army. Redans joined by curtains are those most easily constructed; but as the ditches can only be defended by an oblique fire, the curtains are occasionally so broken as to form nearly right angles with the faces of the redan; they then become *lines of tenailles*.

Lines en Crémaillière have long faces with perpendicular flanks. *Lines with intervals* are often as effective as continued lines. They consist of detached works, in two lines, within musketry fire of each other. The re-entering angle should as nearly as practicable be a right angle. The celebrated lines of Torres Vedras, before adverted to, consisted of 150 detached forts.

Tête-du-pont, is a work constructed to cover the approaches to a bridge, and will be found described under BRIDGE-HEAD.

A *tenaille* is the reverse of a redan, and consists of two faces forming a re-entering angle: it can only be used in connection with some other work.

A *flèche* is a breastwork of two faces, forming a salient angle, constructed on the exterior of a glacis, usually at its foot, in order to defend the ground before a bastion or ravelin.

Having now explained the principal forms which elemental works of F. are made to assume, we proceed to describe—very briefly, of course—the systems into which these have been incorporated for the defense of fortresses, towns, and other permanent purposes. It will merely be necessary to state, in addition to what has been already written, that a *rampart* is a raised structure of earth or stone, above the mean level of the country, on which the parapets, etc., can be thrown up, and which affords to the town or space protected the extra cover of its height, while it elevates the inner works sufficiently to enable them to command and fire over those situated exteriorly to themselves. It need scarcely be said that a line which can be made of earth may equally be constructed of any other material which circumstances may render desirable, the maximum resistance and minimum liability to splinter being the qualities to be chiefly considered.

SYSTEMATIC FORTIFICATION FOR PERMANENT WORKS.—Adverting to the most ancient fortifications mentioned in history, we find Greek cities surrounded with walls of brick and rubble, and occasionally of stone in huge blocks. Babylon had a wall of prodigious circuit—100 ft. high, 32 ft. thick, and surmounted by towers. Jerusalem, at the time of Vespasian's siege, had similar walls with masonry of enormous solidity. These seem to represent F. as it stood from the time of that emperor to the introduction of cannon for breaching purposes. Then the square and round towers, which had formed sufficient flanking defense against arrows, proved useless when cannon-balls, fired from a distance, were the instruments of assault. At the same time, the walls, which had resisted battering-rams, crumbled to atoms under the strokes of artillery.

Fortunately, however, the art of defense has always made equal progress with that of attack; and, early in the 15th, if not late in the 14th c., the Italians had commenced to flank their walls with small bastions. The bastions at Verona, built by Micheli in 1523, are usually looked upon as the oldest extant specimen of modern fortification. Tartaglia and Albert Dürer, painter and engineer, were early in the field. In most of the early systems the face of the bastion was perpendicular to its flank. The first principles were successively improved by Marchi, an Italian, who died 1599, by Errard Bois-le-Duc, and De Ville, under Henry IV. and Louis XIII. of France. The count de Pagan, whose treatise appeared in 1645, did much towards demolishing previous errors, and laid the basement of that science which Vauban subsequently wrought almost to perfection. Born in 1643, Vauban had a genius which penetrated in every direction, equally in the ways of war and in those of peace. He might possibly have taught how fortresses could be rendered impregnable, had not the restless ambition of his master, Louis XIV., led him to demonstrate, first, that the reduction of any work was a mere question of time and powder. His talent so improved the system of attack, that even he himself could not construct a rampart that should withstand the fire conjured up against it by his discoveries. He constructed 33 new fortresses, improved above 100, and conducted personally more than 50 sieges. To him are soldiers indebted for the sweeping fire of ricochet, and to him in a degree for the traverses which endeavor to render it harmless. Coehoorn, director-general of the fortresses of the United Provinces, was the contemporary, rival, and opponent of Vauban; his masterpiece is Bergen-op-Zoom. Cormontaigne, Belidor, Montalembert, Bousmard, and Carnot may also be mentioned as conspicuous masters in the science.

Irrespective of irregularities in the form of the place to be defended, a particular polygon is selected as that on which the lines of defense are to be drawn. Each side of this is a *face of defense*, and the length of a side is rarely made greater than 360 yards.

Vauban's second and third systems were those in which he adapted old walls to his modern improvements. Availing himself of the works already formed, he added counterguards in front of the corner-towers, thereby making hollow bastions, and avoiding the necessity of entirely rebuilding.

Coehoorn's system had counterguards in front of the bastions and parallel to them. The flanked angle of his ravelin had a fixed value—viz., 70°.

Cormontaign widened the gorge of his ravelin, thereby reducing the length of the bastion face available for breaching from without. He also revived the step-like formation of the covered way, originally seen in Speckle in the 16th c., and which gives defenders a continued line of fire from each traverse along the covered way.

The modern system differs but little from that of Cormontaigne. The re-entering places of arms have circular fronts instead of angular; the angle of the ravelin is fixed at 60°, and all the best points of older styles are associated.

The elements of fortifying against shipping will be found under MARINE FORTIFICATION; the principles of attacking fortresses generally, under SIEGE, and MINES MILITARY.

FORTIGUER'RA, NICOLO, an Italian poet, was b. at Pistoja, Nov. 7, 1674. Destined from youth for the church, he proceeded to Rome at an early period, where the power of the prelate Carlo A. Fabroni, who was his relative, speedily secured him advance-

ment, and where he was ultimately raised to the dignity of prelate and papal chamberlain by Clement XI. An ardent cultivator and protector of letters, it must be owned that F.'s own compositions are more prized for a certain rich joviality of imagery, and profuse facility of language, than for any salient beauty of style or conception. His chief work, *Il Ricciardetto*, was originally commenced in confutation of friends, who maintained that the striking ease and fluency of Ariosto, Berni, and other poets of a similar school, were but apparent, and in reality the fruit of deep art and severe labor. F., in *a few hours*, threw off an entire canto of *Il Ricciardetto*, strikingly in imitation of the above poets, and continued the work at random much beyond its original by designed limits. It was published in 1738, two years after his death, and met with unequivocal favor, notwithstanding the incredible incidents and licentious images with which it is replete. F. died 7th Feb., 1735.

FORT JACKSON, on the Mississippi, 78 m. below New Orleans, was built 1824–32, but enlarged and repaired in 1841. This and fort St. Philip, on the opposite bank, defend the city from maritime attack. After the passage of the South Carolina ordinance of secession, the state authorities of Louisiana seized these forts, strongly fortified them, and stationed a fleet above. Admiral Farragut, having been appointed by the United States government in command of a fleet for their recapture, sailed from Hampton roads, on the *Hartford* and having reached Ship island, April 20, called a council of war, and issued his general order to the fleet. In accordance with this, the whole fleet, April 24, at 2 A.M., moved up the river in two columns, and passed successfully, in the face of a tremendous fire from the forts and confederate vessels. After the destruction of the vessels above, and the surrender of the city, the forts were given up.

FORT LEE, a small village in Hudson co., N. J., on the w. bank of the Hudson river, opposite New York. It is a favorite place of resort in the summer for strangers and residents of the metropolis, as it is situated at the base of the palisades, which rise from the river, a perpendicular wall of rock on the w. side, from 150 to 250 ft. high, and 10 m. in extent. This mass of rock furnishes the paving stones for the streets of New York and other cities. After the battle of White Plains, in the revolution, gen. Washington crossed the Hudson river and took a position near Fort Lee. At the same time the British were getting possession of Fort Washington (on the e. side of the river, directly opposite Fort Lee), and Cornwallis prepared with a force of 6,000 men to secure Fort Lee. Washington's force was unequal to a defense, and he retreated southward until he had passed the Delaware, abandoning large amounts of military stores.

FORT MADISON, the seat of justice of Lee co., Iowa; on the Mississippi river, and the Burlington and South-western, and the Burlington and Keokuk railroads; pop. 4,305. The state prison is here. The manufacture of farm implements is the principal business.

FORT MAJOR, the next officer to the governor or commandant in a fortress. He is expected to understand the theory of its defenses and works, and is responsible that the walls are at all times in repair. He is on the staff, but has to resign his regimental appointment, and receives an addition to his half-pay.

FORT MONROE, at Old Point Comfort, on the n. side of the channel, defending, with fort Wool, a mile distant on the s., Hampton roads, Norfolk, and the Gosport navy-yard. This structure is more properly a fortress, containing, besides barracks for soldiers and storehouses, also a United States school of artillery, arsenal, chapel, and other buildings, and covers 80 acres. It is an irregular hexagon, surrounded by a tide-water ditch 8 ft. deep at high-water. It was commenced in 1817, designed to mount 371 guns, has cost nearly $3,000,000, and is not yet completed. The fortress was designed, at the close of the war of 1812–14, by gen. Simon Bernard, an eminent foreign engineer, who planned the works on a scale of great magnitude, after the model of European forts, but no other fortification in this country is constructed like it.

FORT MOULTRIE, on Sullivan's island, at the entrance of Charleston harbor, so named in honor of col. William Moultrie, who, in command of South Carolina troops, June 28, 1776, successfully repelled the attack of the British fleet under sir Peter Parker. It was subsequently rebuilt, and was occupied by maj. Robert Anderson at the commencement of the civil war in 1860, who, abandoning it Dec. 26, removed his forces to fort Sumter.

FORTROSE or FORTROSS, a parliamentary and royal burgh, seaport, and watering-place in the e. of Ross-shire, on the w. side of the Moray firth, opposite fort George, 10 m. n.n.e. of Inverness. Pop. '71, 911. It unites with Inverness, Forres, and Nairn in sending a member to parliament. F. had a fine cathedral and a bishop's palace; but both of these buildings were partially destroyed under Cromwell, and the stones sent to Inverness, to be used in building a fort there. F. is now of little importance, but, in the 16th c., it had a considerable trade, and is said to have been the seat of arts, science, and divinity in the n. of Scotland. Previous to 1444, it was known by the name of Chanonry, but in that year it was united with the adjacent burgh of Rosmarkie under the name of Fortross.

FORT ROYAL, a fortified seaport of the French island of Martinique, in the West Indies, is the capital of the colony. It stands on the w. coast, in a bay of its own name, in

lat. 14° 35′ n., and long. 61° 4′ west. It has a population of about 12,000, and contains offices for the local government, barracks, arsenal, and hospital.

FORT SAINT DAVID, on the Coromandel or e. coast of Hindustan, belongs to the district of South Arcot and presidency of Madras. It is 3 m. to the n. of Cuddalore, and 100 to the s. of Madras, in lat. 11° 45 n., and long. 79° 50′ east. The place became British in 1691. It occupied a prominent position in the great struggle for supremacy between England and France. From 1746 to 1758, it was the capital of the settlements of the former power in the Carnatic; but soon afterwards, its fortifications having been demolished, it sank into comparative insignificance.

FORT SCOTT, a city in Bourbon co., Kan., on the Marmiton river, and the Missouri, Kansas and Texas railroad: pop. 4,174. It is one of the most important towns in that part of the state. The mining and shipping of bituminous coal is the leading business. In 1842, it was a military post.

FORTS AND FORTALICES. The military power of the state is intrusted by the constitution of this country to the sovereign. After having been unconstitutionally claimed by the long parliament in the time of Charles I., it was again vindicated for the crown by 2 Car. II. c. 6. This branch of the royal prerogative extends not only to the raising of armies and the construction of fleets, but to the building of forts and other places of strength. Sir Edward Coke lays it down (1 *Inst.* 5), that no subject can build a house of strength embattled without the license of the king; and it was enacted by 11 Henry VII. c. 18, that no such place of strength could be conveyed without a special grant.

FORT SMITH, a city in Sebastian co., Ark., near the w. boundary of the state, on the Little Rock and Fort Smith railroad, at the junction of the Arkansas and the Poteau rivers; pop. 2,227. It is a flourishing place, with considerable trade. The U. S. district court having jurisdiction over the adjoining Indian territory holds its sessions in this place.

FORT SUMTER, on an artificial island at the entrance of the harbor of Charleston, S. C., 3½ m. from the city, and 1 m. from fort Moultrie. It was begun 1829, but being unfinished, maj. Robert Anderson, before the outbreak of the rebellion in 1860, occupied fort Moultrie with a small garrison of 75 men. On learning that the secessionists of South Carolina designed to take this and other forts in the harbor, he transferred his forces, Dec. 26, to Fort Sumter. An attempt to supply it with provisions and troops by steamship from New York, early in 1861, having failed, and powerful batteries commanding it at every point having been erected, gen. Beauregard, with a strong rebel force, demanded, April 11, an immediate surrender, maj. Anderson agreed to capitulate if not reinforced by the 15. Beauregard commenced its bombardment on the 12, and as the provisions and ammunition were nearly exhausted, the fort was evacuated on the 14, the garrison marching out with the honors of war. The fort was then strongly garrisoned by the rebels, and though bombarded by a fleet under admiral Du Pont, and assaulted by batteries on Morris island, it was not taken till Charleston was abandoned in Feb., 1865.

FORTS OF THE UNITED STATES. The following list comprises the military posts, garrisons, and stations occupied by troops of the United States on the 31st of Oct., 1879:

SEA AND GULF COASTS.

Fort Sullivan	Eastport, Me.
Fort Knox	Bucksport, Me.
Fort Popham	Parker's Head, Me.
Fort Georges	Portland, Me.
Fort Preble	Portland, Me.
Fort Scammel	Portland, Me.
Portland Head battery	Portland, Me.
Fort McClary	Kittery, Me.
Fort Constitution	Newcastle, N. H.
Jerry's Point battery	Portsmouth, N. H.
Fort Lee	Salem, Mass.
Fort Independence	Boston, Mass.
Fort Warren	Boston, Mass.
Fort Winthrop	Boston, Mass.
Long Point batteries	Provincetown, Mass.
Long Island battery	Provincetown, Mass.
Fort Andrew	Plymouth, Mass.
Fort Standish	Plymouth, Mass.
Fort Phoenix	Fairhaven, Mass.
Clark's Point fort	New Bedford, Mass.
Fort Adams	Newport, R. I.
Fort Wolcott	Newport, R. I.
Dutch Island fort	Jamestown, R. I.
Fort Griswold	New London, Conn.
Fort Trumbull	New London, Conn.
David's Island	New Rochelle, N. Y.
Fort Schuyler	Long Island, N. Y.
Willett's Point	Long Island, N. Y.
Fort Columbus	New York harbor.
Fort Wood	New York harbor.
Fort Wadsworth	Narrows, N. Y. harbor.
Fort Hamilton	Narrows, N. Y. harbor.
Fort Lafayette	Narrows, N. Y. harbor.
Sandy Hook fort	Sandy Hook, N. J.
Finn's Point battery	Salem, N. J.
Fort Mifflin	Philadelphia, Pa.
Fort Delaware	Delaware City, Del.
Fort McHenry	Baltimore, Md.
Lazaretto Point fort	Baltimore, Md.
Fort Carroll	Baltimore, Md.
Fort Washington	Fort Washington, Md.
Fort Foote	Opp. Alexandria, Va.
Fort Monroe	Old Point Comfort, Va.
Fort Wool	Old Point Comfort, Va.
Fort Whipple	Georgetown, Va.
Washington arsenal	Washington, D. C.
Fort Macon	Beaufort, N. C.
Fort Caswell	Smithville, N. C.
Fort Johnston	Smithville, N. C.
Fort Sumter	Charleston, S. C.
Fort Moultrie	Charleston, S. C.
Fort Johnson	Charleston, S. C.
Castle Pinckney	Charleston, S. C.
Charleston barracks	Charleston, S. C.
Fort Jackson	Savannah, Ga.
Fort Pulaski	Savannah, Ga.
Oglethorpe barracks	Savannah, Ga.
Fort Clinch	Fernandina, Fla.
Fort Marion	St. Augustine, Fla.
St. Francis barracks	St. Augustine, Fla.
Fort Jefferson	Key West, Fla.
Fort Taylor	Key West, Fla.

Key West barracks	Key West, Fla.
Fort Brooke	Tampa, Fla.
Fort Pickens	Warrington, Fla.
Fort Barrancas	Warrington, Fla.
Fort McKee	Warrington, Fla.
Fort Gaines	Mobile, Ala.
Fort Morgan	Mobile, Ala.
Ship Island	Mississippi City, Miss.
Fort Macomb	Lake Borgne, La.
Fort Livingston	Barataria Bay, La.
Battery Benvenue	New Orleans, La.
Dupre's tower	New Orleans, La.
Jackson barracks	New Orleans, La.
Fort Jackson	Below New Orleans, La.
Fort Pike	Below New Orleans, La.
Fort St. Philip	Below New Orleans, La.
Fort San Diego	Corpus Christi, Tex.
San Diego	San Diego, Cal.
Alcatraz island	San Francisco, Cal.
Angel island	San Francisco, Cal.
Fort Point	San Francisco, Cal.
Lime Point fort	San Francisco, Cal.
Point San José	San Francisco, Cal.
Presidio	San Francisco, Cal.
Yerba Buena island	San Francisco, Cal.
Fort Stevens	Astoria, Oreg.
Fort Canby	near Astoria, W. T.
Fort Townsend	Port Townsend, W. T.
Vancouver barracks	Vancouver, W. T.

FRONTIER STATIONS.

Fort Montgomery	Rouse Point, N. Y.
Plattsburg barracks	Plattsburg, N. Y.
Madison barracks	Sackett's Harbor, N. Y.
Fort Ontario	Oswego, N. Y.
Fort Niagara	Lewiston, N. Y.
Fort Porter	Buffalo, N. Y.
Fort Wayne	Detroit, Mich.
Fort Gratiot	Gratiot, Mich.
Fort Brady	Sault Ste. Marie, Mich.
Fort Bliss	El Paso, Tex.
Fort Davis	Presidio co., Tex.
Fort San Felipe	Del Rio, Tex.
Fort Duncan	Eagle Pass, Tex.
Fort Clark	Brackettsville, Tex.
Fort McIntosh	Laredo, Tex.
Fort Ringgold	Rio Grande City, Tex.
Fort Brown	Brownsville, Tex.

INTERIOR STATIONS.

Kennebec arsenal	Augusta, Me.
Springfield arsenal	Springfield, Mass.
Watertown arsenal	Watertown, Mass.
New York arsenal	New York City.
Watervleit arsenal	Watervleit, N. Y.
U. S. Military Academy	West Point, N. Y.
Frankford arsenal	Philadelphia, Penn.
Allegheny arsenal	Pittsburg, Penn.
Carlisle barracks	Carlisle, Penn.
Pikesville arsenal	Pikesville, Md.
Mt. Vernon barracks	Mt. Vernon, Ala.
Augusta arsenal	Augusta, Ga.
Atlanta	Atlanta, Ga.
Rock Island armory	Rock Island, Ill.
Fort Snelling	Fort Snelling, Minn.
Newport barracks	Newport, Ky.
Little Rock barracks	Little Rock, Ark.
Indianapolis arsenal	Indianapolis, Ind.
Columbus barracks	Columbus, O.
Jefferson barracks	Jefferson City, Mo.
St. Louis barracks	St. Louis, Mo.
Fort Leavenworth	Fort Leavenworth, Kan.
Military prison	Fort Leavenworth, Kan.
Fort Dodge	Dodge City, Kan.
Fort Hays	Hays City, Kan.
Fort Riley	Fort Riley, Kan.
Fort Wallace	Fort Wallace, Kan.
Fort Hartsuff	Calamus, Neb.
Fort McPherson	Cottonwood Springs, Neb.
Fort Omaha	Omaha, Neb.
Fort Sidney	Sidney, Neb.
Fort Robinson	Fort Robinson, Neb.
North Platte station	North Platte, Neb.
Fort Garland	Fort Garland, Col.
Fort Lewis	Pagosa Springs, Col.
Fort Lyon	Fort Lyon, Col.
Fort Halleck	Fort Halleck, Nev.
Fort McDermit	Fort McDermit, Nev.
Fort Harney	Camp Harney, Or.
Fort Klamath	Linkville, Or.
Benicia arsenal	Benicia, Cal.
Benicia barracks	Benicia, Cal.
Fort Bidwell	Fort Bidwell, Cal.
Fort Yuma	Fort Yuma, Cal
San Antonio arsenal	San Antonio, Tex.
Fort Concho	Fort Concho, Tex.
Fort Elliot	Fort Elliot, Tex.
Fort Griffin	Fort Griffin, Tex.
Fort McKavett	Fort McKavett, Tex.
Fort Stockton	Fort Stockton, Tex.
Fort Gibson	Fort Gibson, Ind. Ter.
Fort Sill	Fort Sill, Ind. Ter.
Fort Supply	Fort Supply, Ind. Ter.
Camp on Canadian Riv.	Indian Territory.
Fort Bayard	Fort Bayard, N. Mex.
Fort Gray	Fort Gray, N. Mex.
Fort Marcy	Fort Marcy, N. Mex.
Fort McRae	Aleman, N. Mex.
Fort Selden	Selden, N. Mex.
Fort Stanton	Fort Stanton, N. Mex.
Fort Union	Fort Union, N. Mex.
Fort Wingate	Fort Wingate, N. Mex.
Fort Lowell	Tucson, Ariz.
Camp Huachuca	Tucson, Ariz.
Fort Bowie	Apache Pass, Ariz.
Camp A. Rucker	Fort Bowie, Ariz.
Fort Mojave	Mojave City, Ariz.
Fort Grant	Fort Grant, Ariz.
Fort Apache	Allen, Ariz.
Whipple barracks	Prescott, Ariz.
Fort Verde	Fort Verde, Ariz.
Fort McDowell	Fort McDowell, Ariz.
Fort Sisseton	Fort Sisseton, Dak.
Fort Pembina	Pembina, Dak.
Fort Meade	Fort Meade, Dak.
Fort Hale	Fort Hale, Dak.
Fort Buford	Fort Buford, Dak.
Fort Bennett	Fort Bennett, Dak.
Fort Abraham Lincoln	Fort A. Lincoln, Dak.
Fort Randall	Fort Randall, Dak.
Fort Sully	Fort Sully, Dak.
Fort Stevenson	Fort Stevenson, Dak.
Fort Totten	Fort Totten, Dak.
Fort Yates	Fort Yates, Dak.
Fort Benton	Helena, Mont.
Fort Missoula	Mt. Missoula, Mont.
Fort Keogh	Fort Keogh, Mont.
Fort Logan	Fort Logan, Mont.
Fort Shaw	Fort Shaw, Mont.
Fort Custer	Fort Custer, Mont.
Fort Ellis	Fort Ellis, Mont.
Fort Assinniboine	Fort Assinniboine, Mont.
Boise barracks	Boise City, Ida.
Fort Hall	Blackfoot, Ida.
Fort Lapwai	Fort Lapwai, Ida.
Fort Cœur d'Alene	Fort Cœur d'Alene, Ida.
Camp Howard	Mt. Idaho, Ida.
Fort Douglas	Salt Lake City, Utah.
Fort Cameron	Beaver City, Utah.
Cheyenne depot	Cheyenne City, Wyo.
Fort D. A. Russell	Cheyenne City, Wyo.
Fort Sanders	Laramie City, Wyo.
Fort Laramie	Fort Laramie, Wyo.
Fort McKinney	Fort McKinney, Wo.
Fort Fetterman	Fort Fetterman, Wyo.
Fort Fred. Steele	Fort F. Steele, Wyo.,
Fort Washakie	Fort Washakie, Wyo.
Chelan Camp	Walla Walla, Wash. T
Fort Walla Walla	Walla Walla, Wash. T.
Fort Colville	Fort Colville, Wash. T.

FORTU'NA, called by the Greeks, *Tyche*, was in classical mythology the goddess of chance. According to Hesiod, she was a daughter of Oceanus; according to Pindar, a sister of the Parcæ. She differed from Destiny or Fate, in so far that she worked without law, giving or taking away at her own good pleasure, and dispensing joy or sorrow indifferently. She had temples at Smyrna, Corinth, and Elis. In Italy, she was extensively worshiped from a very early period; and had many names, such as *Patricia*, *Plebeia*, *Equestris*, *Virilis*, *Primigenia*, *Publica*, *Privata*, *Muliebris*, *Virginensis*, etc., indicating the extent and also the minuteness of her superintendence. Particular honors

were paid to her at Antium and Præneste; in the temple of the former city, two statues of her were even consulted as oracles. Greek poets and sculptors generally represented her with a rudder, as a symbol of her guiding power; or with a ball, or wheel, or wings, as a symbol of her mutability. The Romans proudly affirmed that when she entered their city, she threw away her globe and put off her wings and shoes, to indicate that she meant to dwelt with them forever.

FORTUNATE ISLANDS. See CANARIES.

FORTUNA'TUS is the title of one of the best people's books (*Volksbücher*) ever written. It originated about the middle of the 15th c., though many of the tales and legends included in it are of much older date. The opinion that it was worked up into German from a Spanish or English original may be considered as set aside. The substance of the book is that F., and his sons after him, are the possessors of an inexhaustible purse of gold and a wishing-cap, which, however, in the end, prove the cause of their ruin. The moral is that worldly prosperity alone is insufficient to produce lasting happiness. The oldest printed edition of the book now extant bears the date Frankfurt am Maine, 1509. Later German editions mostly bear the title, *Fortunatus, von Seinem Seckel und Wunsch-hütlein* (Fortunatus: Story of his Purse and Wishing-cap. Augsb. 1530; Nürnb. 1677; and Basel, 1699). It has been reprinted in Simrock's *Deutsche Volksbücher* (3 vols., Frankt. am Maine, 1846). Various French versions of the German story have appeared from time to time, as the *Historie de Fortunatus* (Rouen, 1670); which served as the groundwork of the Italian *Avennimenti de Fortunatus e de' Suoi Figli* (Naples, 1676). From the German original, have also sprung, among others, the Dutch version *Een Nieuwe Histoire van Fortunatus Borse en van Zijnen Wensch hoed* (Amst. 1796); later, the English *History of Fortunatus and his Two Sons* (London, no date); the Danish *Fortunati pung og önskehat* (Kopen. 1664, 1672, 1695, 1756, 1783); the Swedish *Fortunatus* (1694); and about 1690, two Icelandic versions, one in verse and another in prose. The first to dramatize the subject was Hans Sachs, in his *Der Fortunatus mit dem Wunschseckel* (1553), after whom comes the English Thomas Decker with his *Pleasant Comedie of Old Fortunatus* (1600), a work which had the honor to make its reappearance in German about the year 1620. The most poetical edition of the story is that given by Tieck in his *Phantasus* (3 vols., Berlin, 1816). See Grässe's *Die Sagenkreise des Mittelalters* (Dresd. and Leip. 1842), and Ersch and Gruber's *Encyclopædie* (sect. 1, vol. 46).

FORTUNA'TUS, VENANTIUS HONORIUS CLEMENTIANUS, b. 530; Bishop of Poictiers, the chief Latin poet of his time. He studied at Milan and Ravenna, and in 565 he went to France, where he was received with much favor at the court of Sigbert, king of Austrasia, whose marriage with Brunhilda he celebrated in an epithalamium. After residing a year or more at the court of Sigbert, he traveled in various parts of France, visiting persons of distinction, and composing short pieces of poetry on any subject that occurred to him. At Poictiers he visited queen Radegonda, then living there in retirement, and she induced him to remain there indefinitely. Here he met also the famous Gregory, bishop of Tours, and other eminent ecclesiastics. He was elected bishop of Poictiers in 599, and died about 609. His later poems, collected in 11 books, consist of hymns, epitaphs, poetical epistles, and verses in honor of his patroness Radegonda, and of her sister Agnes, abbess of a convent at Poictiers. He also wrote a poem in four books in honor of St. Martin, and several lives of the saints. His prose is stiff and mechanical, but his poetry has an easy rhythmical flow.

FORTUNE, ROBERT, a distinguished botanist and traveler, was b. in the co. of Berwick in 1813. After completing his education at a Scotch parish school, he served an apprenticeship as a gardener, and obtained employment in the royal botanic garden at Edinburgh. There he had good opportunities of obtaining a sound knowledge of botany and the higher departments of his own profession, so far as they relate to the cultivation of subtropical and tropical plants under glass in a temperate climate, and these opportunities he turned to good account. He afterwards obtained a situation in the gardens at Chiswick, where his abilities and acquirements attracted the attention of London naturalists. He was, in 1842, sent by the botanical society of London to northern China to make a botanical exploration of the country. His journey was most successful, and he sent home a very large number of new and valuable plants. He gave an account of his adventures in his *Three Years' Wanderings in Northern China*, a work which places its author in the foremost rank of contemporary explorers. F., on his return to England, acted for a time as curator of the physic garden at Chelsea. In 1842, he was appointed by the East India company to proceed to China to make investigations relative to the cultivation of the tea-plant; and on his return to England he published a work entitled *Two Visits to the Tea Countries of China*. He was afterwards employed by the American government to collect for them seeds, chiefly those of the tea-plant, in the east. The latest important work by F. was published in 1863. It is entitled *Yedo and Pekin, a Narrative of a Journey to the Capitals of Japan and China*. It devotes special attention to the natural productions and agriculture of the districts visited.

FORTUNE-TELLER. Under the designation vagabonds, in the Scottish act 1579 c. 74, are included all who go about pretending to foretell fortunes. The punishment inflicted on them by the statute is scourging and burning on the ear.

FORTU'NY, MARIANO, 1839–74; a Spanish painter trained in the academy at Barcelona. In 1856, he gained a prize which entitled him to study in Rome for several years, where, instead of haunting the old galleries, he selected his subjects from common life. In 1859, he went with Prim in the expedition to Morocco. The splendid barbarism of Africa captured his imagination, and he returned with studies which were to make his future fame. His reputation dated from 1866, when he settled in Paris. There he entered into most profitable business arrangements with the house of Goupil, who introduced his works not only in Europe but in America. In 1869, several of Fortuny's pictures were exhibited in Paris, and in the salon of 1870, Regnault's "Salome," and the "Education of a Prince," by Zamaeois made the names of these three young men known as the founders of a new school—a school that within four years was deprived by death of its illustrious leaders. In 1868, Fortuny married Mademoiselle Madrazo, a sister of Madrazo the artist, and a daughter of the distinguished director of the royal museum of Madrid, himself an artist. The names of Fortuny's best known pictures are "A Spanish Marriage;" "The Serpent-Tamer;" "The Amateur of Prints;" "A Fantasia at Morocco;" "The Sword-Sharpener;" and "The Academicians of Arcadia." F. made hundreds of sketches in Morocco, in Spain, in Italy, and in the environs of Paris. As an etcher he gained a high repute; and many of his etchings have been reproduced. His pictures, produced with deliberate care, brought great prices: "The Spanish Marriage," 75,000 francs; and many of his water colors more than 15,000 francs apiece. "The Serpent-Tamer," bought by A. T. Stewart of New York, is one of the best specimens of his work.

FORT WASHINGTON, an important military post occupying the highest part of the island of Manhattan during the war of independence. It was on a promontory running into the Hudson river, about 10 m. from the southern point of the island, not far from the present 185th street. After the battles of Long Island, Harlem, and White Plains, Washington retreated through New Jersey, leaving a considerable force in fort Washington. Sir William Howe, the British commander, undertook the capture of the fort, which was under command of col. Magaw. Works were erected by the British near Harlem river, to play on the opposite works of the Americans, and, every preparation being made, the garrison were summoned to surrender, on pain of being put to the sword. Col. Magaw replied that he should defend the place to the last extremity. The next morning, the royal army made four attacks. The first, on the n. side, was conducted by gen. Knyphausen; the second, on the e., by gen. Matthews, supported by lord Cornwallis; the third, by lieut.col. Stirling; and the fourth, by lord Percy. Soon after daybreak, Nov. 16, 1776, the cannonading began, and continued with great fury on both sides until noon. The Hessians under the command of gen. Knyphausen then filed into two columns, one of which, led by col. Rhalle, having ascended circuitously to the summit of the hill, penetrated through the advanced works of the Americans, and formed within a hundred yards of the covered way of the front. The other column climbed the hill in a direct line; but in passing through a thick wood, suffered much by a well-directed fire from col. Rawling's regiment of riflemen. The second division made good their landing, and forced the Americans from their rocks and trees up a steep and rugged hill. The third division had to encounter a heavy fire previous to their landing, and then to ascend a woody promontory of very uneven surface; but though the post was obstinately defended, it was carried by col. Stirling, who made 200 prisoners. The last division, under lord Percy, having surmounted incredible obstacles, carried the advanced works of the Americans. The British gen., after these decisive advantages, again summoned col. Magaw to surrender. The force of the assailants was too great to be resisted, the fort was too small to contain all the men, and the ammunition was nearly exhausted. The garrison, therefore, consisting of about 2,000 men, surrendered as prisoners of war.

FORT WAYNE, a flourishing t. of the state of Indiana, North America, at the confluence of the St. Joseph and St. Mary rivers, which form the Maumee, and on the Wabash and Erie canal, 122 m. e.n.e. from Lafayette. It is a great railway center, and its growth has been very rapid. A fort was erected here by order of gen. Wayne in 1794, and it continued to be a military post till 1819. Pop. '60, 10,388; '70, 17,718.

FORT WAYNE (*ante*), a city in Allen co., Ind., one of the most important in the northern part of the state; on Maumee river (formed by the St. Mary's and the St. Joseph's); and on the Grand Rapids and Indiana, the Pittsburg and Fort Wayne, and Chicago and Wabash railroads; at the terminus of the Fort Wayne, Jackson, and Saginaw railroad, and on the Wabash and Erie canal; pop. '70, 17,718; in '80, 26,048. It has a court-house, the Concordia Lutheran college, the Fort Wayne (Methodist Episcopal) college, a Roman Catholic convent and two academies, and is the seat of a bishop of that church. It is a place of extensive trade and great enterprise; having a very large number of iron foundries, machine shops, and other manufactories, and several railroad repair shops. The locality was visited by the French about 1700, and not long after-

wards a trading post called Fort Miami was established. In 1760, the English built a fort on the e. bank of the St. Joseph's near the mouth. In 1794, gen. Wayne built the government post, and the name still remains.

FORT WILLIAM, a village in the district of Thunder bay, province of Ontario, Canada, on the Kaministiquia river, near lake Superior; pop. 508. The fort was built by the Hudson Bay company in 1803. It is now an important landing-place for lake steamboats, and a station on the Pacific railroad. There are rich silver mines in the vicinity.

FORT WILLIAM, a village in Inverness-shire, near the w. base of Ben Nevis, 63 m. s.w. of Inverness, and at the s. end of the Caledonian canal. A fort was originally built here by gen. Monk, and afterwards rebuilt on a smaller scale by William III. It is an irregular work, with ditch, glacis, ravelin, bomb-proof magazine, and barracks for 100 men. It resisted sieges by the Highlanders in 1715 and 1745. It is now converted into private houses. F. W., so long one of the keys of the highlands, is now, like Oban, only a center for tourists. Pop. '71, 1212.

FORT WILLIAM (INDIA). See CALCUTTA.

FORT WILLIAM HENRY, and FORT GEORGE; the first, a fortress constructed in 1755 near lake George by the British under sir William Johnson. During the French war it was a very important point. In 1757, it was captured by the French, aided by the Indians. It was besieged by the marquis de Montcalm with a force of 9,000 men. The garrison consisted of between 2,000 and 3,000, and the fortifications were in good condition. But within six days, col. Monroe, the English commander, capitulated. The garrison was to be allowed the honors of war, and to be protected until the men could reach fort Edward; but no sooner had the soldiers left the place than the Indians attached to the French army, disregarding the stipulation, fell upon them with a general butchery. These Indians had been employed by the French with the promise that they might take such plunder as they could; and the British officers reported that the troops were robbed, that they were dragged from the ranks and killed. The New Hampshire regiment, which happened to be in the rear, lost 80 out of 200 men. Fort George, now a mere ruin, was about half a mile e. of fort William Henry.

FORT WORTH, the seat of justice of Tarrant co., Texas, on Trinity river and the Texas and Pacific railroad, 175 m. n. of Austin; pop. 2,300.

FO'RUM, a Latin word, which originally signified an "open place," and is probably connected with *foras*, "out-of-doors." The Roman *fora* were places where the markets and courts of justice were held. The former were termed *fora venalia*, and the latter *fora judicialia*. Of the *fora judicialia*, the most ancient and celebrated was the *forum Romanorum*, or, *par excellence*, the *forum magnum*, occupying the quarter now known as the *campo vaccino* (or cattle-market). It stretched from the foot of the Capitoline hill, where the arch of Septimius Severus stands, to the temple of the Dioscuri, was seven *jugera* in extent, and was surrounded by streets and houses. The boundary on the e. and n. was the *Sacra via*, of which the side nearest the F. was left open; while on the other were corridors and halls, such as those of the *argentarii* (bankers or money-changers). At a later period, the site of these was, for the most part, occupied by basilicas and temples. In the eastern portion of this space, were held the earliest *comitia* (q.v.) of the Romans—the *comitia curiata;* hence this part took the name of the *comitium*, and was distinguished from the F. strictly so called. Here were hung up for the benefit of the public the laws of the twelve tables; and, after 304 B.C., the *fasti* written on white tables to inform the citizens when the law-courts were open. The *forum*, in the narrower usage of the word, probably ceased to be employed as a market-place about 472 B.C., when it became the place of assembly of the *comitia tributa*. Of the later *fora venalia*, the principal were the *forum boarium* (the cattle-market), the *forum suarium* (pig-market), *piscatorium* (fish-market), *olitorium* (vegetable-market), etc. Public banquets for the populace, and the combats of the gladiators, were, in the time of the republic, usually held in the great F., which also contained monuments of various kinds, of which may be mentioned the famous *columna rostrata* of C. Duilius, erected in memory of his victory over the Carthaginians. The rostra, or platforms from which public orations were delivered, formed the boundary between the F. in its narrow usage and the comitium. After the time of Julius Cæsar and Augustus, the F. Romanorum lost the importance it had previously derived from being the central point of Roman political life. The other two *fora judicialia* were the *forum Julii* and the *forum Augusti*. Compare Becker, *Handbuch der Röm. Alterthümer* (1 vol., Leipsic, 1843).

FORUM COMPETENS, in law, is the court to the jurisdiction of which the party is amenable.

FORWARDING, the business of receiving and transmitting goods, for doing which the forwarding merchant or warehouseman assumes the expense of transportation, and receives compensation from the owners; but he has no concern with the means of transportation, and no interest in the freight. Such a person is not deemed a common carrier, but is merely a warehouseman or agent, and is required only to use ordinary diligence in sending the property by responsible persons. Forwarding in the United States, like the express business, has become immense; indeed the two are so closely

allied that it is difficult to separate them in description. See Carriers, Common; Express.

FOSCARI, Francesco, doge of Venice from 1423 to 1457, a brilliant period of conquest and prosperity to his country, and of unexampled affliction to himself and family. Born about 1370, his aspiring ambition soon fired him with passionate eagerness to exalt his reign by the glory of conquest, and speedily involved the state in a severe conflict with the dukes of Milan; which, however, the doge's great military ability in the end turned into a source of glory and aggrandizement to Venice. His triumph was embittered by the successive loss of three sons; and the one who remained to transmit the name, and succeed to the inheritance of the family, was, in 1445, denounced for having received bribes from the hostile generals, to use his influence with the doge in procuring less rigorous terms. Tried for this grave crime before the tribunal of the ten, and racked cruelly in view of his father, Giacopo Foscari was banished for life, under pain of death should he attempt to revisit his native land. In 1450, the assassination of one of the "Council of Ten," Hermolao Donati, was imputed, on what seem most unfounded grounds, to Giacopo, who was consequently summoned from his exile, tried, tortured, and banished a second time on still more rigorous terms to the island of Candia. Grown reckless through suffering, and longing to see his home and country on any terms, Giacopo petitioned the duke of Milan to intercede in his behalf with the senate, a step which, by Venetian law, was punished as a high crime, and led to the unfortunate Giacopo being for the third time subjected to torture and renewed banishment, on entering into which he died of grief. The doge had vainly besought permission to resign a dignity grown loathsome to him, from its imposing the barbarous obligation of witnessing his son's torture; but in the end he was deposed and ordered to vacate the palace in three days. At the age of 87, decrepit from years, and bowed by sorrow and humiliation, Francesco F., supported by his venerable brother, descended the giant's staircase, and passed out forever from the ducal palace, the scene of such vain pomp and bitter misery. Pasqual Malapieri was elected in his stead in 1457, and at the first peal of the bells in honor of his elevation, F. expired from the rupture of a blood-vessel. Byron has written a tragedy on the subject, entitled *The Two Foscari.*

FOSCO'LO, Ugo, an Italian author, was b. about 1778, at Zante, one of the Ionian isles, and proceeded to Venice in his 16th year, where for a time he pursued his studies, repairing later to Padua to enjoy Melchiore Cesarotti's noble course of classic literature. His earliest efforts at poetical composition were strictly modeled on his favorite Greek classics; and, as early as 1797, his tragedy, *Il Tieste,* was received with favor by a critical Venetian audience. The dismemberment of the Venetian states, decreed by the treaty of Campo Formio, bitterly incensed F.'s patriotic spirit, and inspired him with one of his most remarkable works, *Le Lettere de Jacopo Ortis,* which, owing to the fierce political excitement then prevailing throughout the entire peninsula, was received with immense popularity. F. repaired to Milan on its being declared the capital of the Cisalpine republic, and there obtained the grade of officer in the Lombard legion. On the downfall of the republic, he retreated with the French into Genoa, where, in the midst of the terrors of a rigorous siege, he composed two exquisite odes to *Luigia Pallavicini Caduta da Cavallo,* and *All' Amica risanata.* F. subsequently entered France with the intention of joining Napoleon's expedition against England, and prepared a much admired version of Sterne's *Sentimental Journey,* to exercise himself in English. On the failure of the plan, he returned to Milan, and prepared a splendid edition of Montecuculi's works, with notes and historical references—*Opere di Raimondo Montecuculi, per* Luigi Mussi (Milan, 1807–8), a very rare edition. At this time, he also published his exquisite poem, in blank verse, *I Sepolcri,* which at once placed him among the classic authors of his country. In the same year, he was appointed to the chair of eloquence in Pavia, and continued to occupy the post to the delight and benefit of his students, until the professorship was suppressed in all the colleges of Italy. His inaugurative address, *Dell' Origine e dell' Ufficio della Letteratura,* is a masterpiece of beautiful, noble, and patriotic writing. From the time F. lost faith in the sincerity of Bonaparte's intentions to his country, he not only ceased to worship his early idol, but employed the full powers of his wrath and sarcasm in denouncing his treachery. After various vicissitudes, F. finally sought refuge in Britain about 1816, and soon mastered the language sufficiently to contribute to the *Quarterly* and *Edinburgh Reviews.* In London, some of his best writings were published—viz., *Essays on Petrarca and Dante; Discorso sul testo del Decamerone; Discorso storico sul testo di Dante;* and various minor compositions. He died Oct. 10, 1827, of dropsy, at Turnham Green near London. His works in prose and verse were published in Milan, 1822, by Silvestri.

FOSS, Cyrus David, d.d., b. N. Y., 1834; one of the bishops of the Methodist Episcopal church, graduated from Wesleyan university in 1854, and was afterwards appointed teacher of mathematics in Amenia seminary, N. Y., and, in 1856, principal of the same institution. In 1857, he joined the New York conference, and in that and the New York east conference served important appointments until 1875, when he was elected president of Wesleyan university. He was a member of the general conference in 1872 and 1876. In 1880, he was elected one of the bishops of the church, and, at present, has his residence at St. Paul, Minn.

FOSS, or FOSSE (Lat. *fossa*, from *fodio*, I dig), in fortification, is a ditch or moat, either with or without water, the excavation of which has contributed material for the walls of the fort it is designed to protect. The F. is immediately without the wall, and offers a serious obstacle to escalading the defenses.

FOSSA ET FURCA, or PIT AND GALLOWS, was an ancient privilege granted by the crown to barons and others, which implied the right of drowning female felons in a ditch, and hanging male felons on a gallows.

FOSSA MARIANA, the canal made 102 B.C., by Marius from the Rhone parallel to the river nearly to the gulf of Stomalimne. It was constructed to avoid the difficult navigation at the mouths of the river caused by the accumulations of sand by the several streams.

FOSSA'NO, a t. of Piedmont, n. Italy, in the province of Coni or Cuneo, is situated on the left bank of the Stura, on a hill surmounted by an old castle, 14 m. n.e. of Coni. It is surrounded with old walls, and is well built; but the houses are erected over arcades, under which run the footways, and thus the streets have a somewhat gloomy appearance. It has a handsome cathedral, ten churches, a royal college, and numerous minor educational institutions, silk-factories, paper-mills, and tanneries. Pop. '71, 7,272.

FOSSA'NO, AMBROGIO STEFANI DA, better known as AMBROGIO BORGOGNONE, or simply as IL BORGOGNONE, one of the foremost painters of the Milanese school, nearly contemporary with Leonardo da Vinci. His fame is associated with the church and convent of the Carthusians at Pavia, on which he did much work. There are specimens of his work in the national gallery, London. The dates of his birth and death are not known, but he died in the early part of the 16th century.

FOSSIL (Lat. *fossilis*, dug out of the earth), a term formerly applied, in accordance with its derivation, to whatever was dug out of the earth, whether mineral or organic, but now restricted to the remains of plants and animals imbedded in the earth's crust. They were formerly, and are sometimes still, called petrifactions. They occur in nearly all the stratified rocks, which have, on this account, been called fossiliferous strata. It is difficult or impossible to detect them in the metamorphic rocks, for the changes that altered the matrix have also affected the organisms, so as either almost or altogether to obliterate them. In the fundamental mica-schist and gneiss they have escaped notice, if ever they existed; and it is only within the last few years that their presence has been detected in the gneiss and other rocks, which are the greatly metamorphosed representatives of the lower Silurian measures in the n. of Scotland.

The conditions in which fossils occur are very various. In some pleistocene beds the organic remains are but slightly altered, and are spoken of as sub-fossil. In this state are the shells in some raised sea-beaches, and the remains of the huge struthious birds of New Zealand, which still retain a large portion of the animal basis. In the progress of fossilization, every trace of animal substance disappears; and if we find the body at this stage, without being affected by any other change, it is fragile and friable, like some of the shells in the London clay. Most frequently, however, a petrifying infiltration occupies the cavities left in the fossil by the disappearance of the animal matter, and it then becomes hardened and solidified. Sometimes the whole organism is dissolved and carried off by water percolating the rock, and its former presence is indicated by the mold of its outer surface, and the cast of its inner in the rocky matrix, leaving a cavity between the cast and the mold agreeing with the size of the fossil. This cavity is occasionally filled up with calcareous spar, flint, or some other mineral; and we thus obtain the form of the organism, with the markings of the outer and inner surfaces, but not exhibiting the internal structure. The most advanced and perfect condition of fossilization is that in which not only the external form, but also the most minute and complicated internal organization is retained; in which the organism loses the whole of its constituents, particle by particle, and as each little molecule is removed, its place is taken by a little molecule of another substance, as silica or iron pyrites. In this way we find calcareous corals perfectly preserved in flint, and trees exhibiting in their silicified or calcified stems all the details of their microscopic structure—the cells, spiral vessels, or disk-bearing tissue, as well as the medullary rays and rings of growth.

FOSSIL BOTANY. See BOTANY, FOSSIL.

FOSSIL FERNS. As far as has been yet determined from the rocky tablets of the earth's crust, ferns first appeared in the Devonian period, but then only sparingly, not more than nine or ten species having been observed. In the immediately succeeding coal-measures, they suddenly reached their maximum development. The dense forests and the moist atmosphere of this period were so suited to their growth that they formed a large bulk of the vegetation. Upwards of 350 species have been described, some of them tree ferns of a size fitting them to be the companions of the immense sigillarias and lepidodendrons whose remains are found associated with theirs in the carboniferous rocks. Twenty-three species have been found in Permian strata. Many new forms appear in the Trias, and their number is increased in the Oolite. The fresh-water beds of this period contain numerous beautiful ferns, upwards of fifty species having been described. The marine beds of the cretaceous period contain very few forms, and in the tertiary rocks they are equally rare.

FOSSIL FOOTPRINTS. See ICHNOLOGY, *ante*.

FOSSILIF'EROUS ROCKS are those which contain organic remains. If we except the lowest metamorphic rocks, in which, as yet, no fossils have been found, the term is equivalent to the "stratified rocks," when used comprehensively; but it may also be applied to a particular bed, as when we speak of an unfossiliferous sandstone compared with the neighboring fossiliferous shale or limestone.

FOSSOMBRONÉ, a small episcopal t. of Italy, in the province of Urbino and Pesaro, is pleasantly situated on a hill on the left bank of the Metauro—which is here spanned by a fine modern bridge—11 m. e. of the town of Urbino. It rose in the 14th c., from the ruins of *Forum Sempronii*, destroyed by the Goths and Lombards. Some interesting Roman inscriptions and remains of the ancient city are contained in the cathedral of St. Aldobrando. F. is celebrated for its fine manufactures of carpets and woolen cloths, and particularly for the excellent silk of its neighborhood. Three m. from F. is Il Monte d'Asdrubale, famous as the scene of the engagement in which the Carthaginian gen. was defeated and killed by the Romans in 207 B.C. Pop. about 4,500.—See Lauro Jacomo, *Historia e Pianta di Fossombrone*.

FOSTER, a co. in n.e. Dakota on the Cheyenne river, formed since the census of 1870. The Dakota river touches the s.w. part.

FOSTER, ABIEL, 1735–1806; b. Mass., a graduate of Harvard, and pastor of a Congregational church, Canterbury N. H. He was several times in the legislature of New Hampshire, and was a member of congress in 1783–84, 1789–91, and 1795–1803. Later in life, he was chief-justice of the state court of common pleas.

FOSTER, BIRKET, b. England, 1812. At the age of sixteen, he was placed with Mr. Landells, the wood-engraver, by whose advice, after he had practiced engraving for a short time, he became a draughtsman. At the age of twenty-one, he illustrated several children's books, and did much drawing for the *Illustrated London News*. He illustrated Longfellow's "Evangeline," Beattie's "Minstrel," Goldsmith's poetical works, and other similar works of the same kind; and has since drawn for many of the better class of illustrated works that have issued from the press, especially a handsome work devoted to English landscape, with descriptions by Mr. Tom Taylor, published in 1863. Having resolved to follow a different branch of art, and having in 1860 been elected a member of the water-color society, he has met with very great success in that line. He has made a number of carvings on wood, especially of landscape and forest pictures, which are of eminent beauty.

FOSTER, JOHN, a well-known English essayist, was b. in the parish of Halifax, Yorkshire, Sept. 17, 1770. He was educated for the ministry at the Baptist college at Bristol, but after preaching for several years to various small congregations with very indifferent success, he resolved to devote himself mainly to literature. His *Essays, in a Series of Letters*, were published in 1805, while he was officiating as pastor of a Baptist chapel at Frome, in Somersetshire. They were only four in number—On a Man's Writing Memoirs of Himself; On Decision of Character; On the Application of the Epithet Romantic; and On some of the Causes by which Evangelical Religion has been rendered less acceptable to Persons of Cultivated Tastes; yet sir James Mackintosh did not hesitate to affirm that they showed their author to be "one of the most profound and eloquent writers that England has produced." They have been remarkably popular, especially among the more thoughtful of the community, and have gone through upwards of twenty editions. In 1808, F. married the lady to whom his essays were originally addressed, and retired to Bourton-on-the-Water, in Gloucestershire, where he lived a quiet, studious, literary life, preaching, however, in the villages round about on Sundays. In 1819, appeared his celebrated *Essay on the Evils of Popular Ignorance*, in which he urges the necessity of a national system of education. He was long the principal writer in the *Eclectic Review*, and a selection from his contributions to that magazine was published by Dr. Price in 1844. He died at Stapleton, near Bristol, Oct. 15, 1843. F. was a man of deep but somber piety. The shadows that overhung his soul were, however, those of an inborn melancholy, and had nothing in common with the repulsive gloom of bigotry or fanaticism. His thinking is rugged, massive, and original; and at times, when his great imagination rouses itself from sleep, a splendor of illustration breaks over his pages that startles the reader both by its beauty and its suggestiveness. Besides the works already mentioned, F. published several others, of which the most important is an *Introductory Essay to Doddridge's Rise and Progress of Religion* (1825). Compare the *Life and Correspondence* of F. (2 vols. 1846), edited by J. E. Ryland, and republished in Bohn's standard library in 1852.

FOSTER, JOHN GRAY, 1823–74; b. N. H.; graduated at West Point as lieut. of engineers. He served with the sappers and miners in the Mexican war, and was wounded at Molino del Rey. He was afterwards engaged in constructing fortifications in the coast survey, as assistant professor of engineering at West Point, and as engineer in the building of fort Sumter. When the war of the rebellion began, he was chief engineer of the fortifications in Charleston harbor, and was in fort Sumter during the bombardment. In 1861, he was brig.gen. of volunteers, and was distinguished in the capture of Roanoke island, at Newbern, and at fort Macon. He served as maj

gen. in command of the department of North Carolina and Virginia; in 1863, he commanded the department of Virginia and North Carolina; in the end of that year, the department of the Ohio; in 1864, the department of the South; and in 1865, that of Florida. In 1866, he was mustered out of the volunteer service. Returning to the corps of engineers in the regular army, he was given charge of the work for the preservation and improvement of Boston harbor, and the construction of defenses of Portsmouth harbor, N. H. He was made lieut.col. of engineers in 1867. He was the author of *Notes on Submarine Blasting*.

FOSTER, JOHN WELLS, LL.D., 1815–73; an American geologist; b. Mass.; educated at Wesleyan university, and became a lawyer in Ohio. He assisted in, and wrote an account of, the survey of the state. He was associated with prof. J. D. Whitney in his survey of the lake Superior copper region. He published *The Mississippi Valley; Prehistoric Races of the United States;* and several scientific papers. He was land-commissioner for Illinois, and president of the association for the advancement of science.

FOSTER, LAFAYETTE SABINE, LL.D., 1806–80; b. Conn.; educated at Brown university, and admitted to the bar in 1831. He was a member of the Connecticut legislature, and speaker of the lower house; mayor of Norwich; in 1855, U. S. senator; re-elected six years later; and in 1865, was chosen president *pro tem.* of the senate. For two years after the death of president Lincoln, he was acting vice-president of the United States. He was again in the state legislature, and again speaker, and in 1870, by a nearly unanimous vote in the legislature, was chosen judge of the supreme court of Connecticut.

FOSTER, RANDOLPH S., D.D., b. Ohio, 1820; studied in Augusta college (Ky.), and as a profession selected the Methodist ministry. In 1850, he was in the New York conference; in 1856, president of the Northwestern university; in 1858, professor in Drew theological seminary; and in 1872, was chosen bishop. He has published *Objections to Calvinism; Christian Purity; Ministry of the Times;* and *Theism*.

FOSTER, STEPHEN COLLINS, 1826–64; b. Penn.; the author of a great number of popular songs and melodies, among which are: *O Susannah; Nelly was a Lady; Old Uncle Ned; Camptown Races; Old Folks at Home; Willie, we have Missed You; Old Dog Tray; Come where my Love lies Dreaming*, etc. The *Old Folks at Home* is said to have yielded him $15,000. His *Sadly to my Heart Appealing* was written when he was but 13 years old. For most of his songs he wrote both words and music.

FOTHERGILL PROCESS. This is one of the numerous dry processes in photography (q.v.) which have for their object the preservation of sensitive plates ready for exposure. It is named after the inventor, and consists in the partial removal of the free nitrate of silver which adheres to the collodion film on withdrawing it from the sensitizing bath by washing with water, and the subsequent conversion of the remaining free nitrate of silver into albuminate and chloride of silver by pouring over the plate dilute albumen, containing chloride of ammonium, the excess of albumen being finally washed off by violent agitation with a copious supply of water. The plates being set aside to drain on folds of blotting-paper, are, when dry, ready for use. For details of manipulation, see Hardwich's *Photographic Chemistry*.

FOUCAULT, JEAN BERNARD LÉON, 1819–68; a French physicist. He studied medicine, but devoted himself to science, acting as Donné's experimental assistant in the latter's lectures on microscopic anatomy; and investigating, with Figeau, the intensity of sunlight as compared with that of carbon heated in the voltaic arc, and that of lime in the oxyhydrogen blowpipe, and also the duomatic polarization of light. He published in the *Comptes Rendus* of the academy of sciences, 1849, an account of an electro-magnetic regulator for the electric lamp. The following year he proved the greater velocity of light in air than in water, measuring it by the use of a revolving mirror with a concave mirror centered in its axis, and established the law that the velocity of light in different media is inversely as the refractive indices of the media. In 1851, he demonstrated the rotation of the earth on its axis by the diurnal rotation in an e.s.w. direction of the plane of oscillation of a long heavy pendulum freely suspended. The following year, he invented the gyroscope. He became physical assistant in the Paris imperial observatory in 1855. In 1857, he invented the polarizer called by his name, and in 1858, succeeded in giving to the speculum of reflecting telescopes the form of a spheroid or a paraboloid of revolution. He set the great reflector in the telescope of the Paris observatory in 1859. In 1865, he published a series of papers on a modification of Watt's governor, showing how its period of revolution could be made constant, and on an apparatus for regulating the electric light. He also showed how the sun can be observed without injury to the eye from the excess of light. He was editor of the scientific portion of the *Journal des Débats* from 1845. In conjunction with Regnault, he published an important paper on binocular vision. He received the decoration of the legion of honor in 1850, and was made an officer in 1864. He also received many honors from scientific associations in France and England.

FOUCHÉ, JOSEPH, Duke of Otranto, the son of a sea-captain, was b. at Nantes, 29th May, 1763, and educated at the oratoire. He hailed the revolution with enthusiasm,

and in 1792 became a member of the national convention. He voted for the death of Louis XVI., and was one of the commissioners of the committee of public safety sent to Lyons in 1794 to reduce that city to obedience. In 1795, he was expelled from the convention as a dangerous terrorist, and kept in confinement for a short time. After the revolution of the 18th Brumaire (5th Nov., 1799), in which he took a part, F., as minister of police (an office to which he had been appointed on the 31st July of the same year), organized an extraordinary police. He restrained the new government from deeds of violence, and by his advice the list of *émigrés* was closed, a general amnesty proclaimed, and the principle of moderation and conciliation steadily adhered to. His remark upon the execution of the duke d'Enghien was very happy: "*C'est bien pis qu'un crime, c'est une faute*" (It is much worse than a crime; it is a *blunder*). In July, 1804, he was again placed at the head of the police. His chief endeavors were directed, as before, to attaching the royalists to the imperial throne by prudent moderation. In 1809, the emperor conferred on him the title of duke of Otranto, along with large grants from the revenues of the Neapolitan territory. When the English expedition landed on Walcheren (1809), the emperor was absent, and F., who then held the portfolio of the interior, as well as of the police, organized the measures that led to the retirement of the English. In a proclamation issued on this occasion, he made use of a boastful expression which lost him the favor of Napoleon, and in the following year he was forced to resign. In the campaign of 1813, the emperor summoned F. to headquarters at Dresden, and sent him thence as governor of the Illyrian provinces, and, after the battle of Leipsic, to Rome and Naples, in order to keep a watch upon Murat's proceedings. Being recalled to Paris in the spring of 1814, he predicted the downfall of Napoleon even before his arrival in France. After the emperor's abdication, F. advised him to abandon Europe altogether. On his return from Elba, Napoleon again nominated him minister of police; but after the battle of Waterloo, F. placed himself at the head of the provisional government, brought about the capitulation of Paris, and drew back the army behind the Loire, thereby preventing unnecessary bloodshed. At the restoration, Louis XVIII. reappointed him minister of police; but he resigned his office in a few months, and went as ambassador to Dresden. The law of the 12th Jan., 1816, banishing all those who had voted for the death of Louis XVI., was extended to F. also, who from that time resided in different parts of Austria. He died at Trieste, 26th Dec., 1820, leaving an immense fortune. Napoleon, at St. Helena, called F. "a miscreant of all colors;" and Bourrienne declares that he "never regarded a benefit in any other light than as a means of injuring his benefactor"—statements which are far too exaggerated to be worth much. The simple truth appears to be, that F. was a man whose highest principle was self-interest, but whose sagacity was not less conspicuous, and who never failed to give the governments which he served the soundest political advice. It is true, however, that he was unscrupulous in passing from one party to another, and that he was as destitute of political morality as Napoleon himself. In his private relations, the character of F. stands higher than in his public. As father of a family and as a friend he is worthy of all praise. He saved many a life; and harsh measures were often softened by his considerate administration. In 1824 appeared a work entitled *Mémoires de Fouché, Duc d'Otrante*, edited by A. Beauchamp, which, though declared to be spurious by the sons of F., is generally held to have been based on genuine documents.

FOUGERES, a handsome t. of France, in the department of Ille-et-Vilaine, stands on a hill on the right bank of the Couesnon, 28 m. n.e. of Rennes. It is a well-built town, with wide streets, and in the old quarter retains traces of the middle ages in the ancient arcades which still obtrude in some places upon the streets. The castle of F. is picturesque, but being commanded by other parts of the town, forms but a feeble defense. In the neighborhood is a great forest containing Druidical remains. A famous engagement took place here between the Vendean royalists and the republicans, Nov. 15, 1793. F. has manufactures of sail-cloth, canvas, tape, flannel, lace, hats, etc.; and dyeworks, principally for the dyeing of scarlet. In the vicinity are important glass and paperworks. Pop. '76, 10,396.

FOU'LA, or FOULAH, an island of Shetland, parish of Walls, from which it is distant 20 m. in a westerly direction. It extends 3 m. in length by 1½ in breadth, and rises to a height of 1369 ft. above the sea. It is solitary, and with it there is no regular communication. F. has about 250 inhabitants, who subsist by fishing and farming on a small scale. On the island, there is a school maintained by the society for propagating Christian knowledge; there is also a chapel connected with the church of Scotland, and a chapel with a missionary maintained by the Congregational union of Scotland. F. is chiefly remarkable for its sublime cliffs of red sandstone on its north-western side, where the precipice rises from the sea-margin to a height of nearly 1200 ft., being the grandest thing of the kind in the British islands. Among the sea-birds which occupy the cliffs is the skua gull, or bonxie (*lestris cataractes*). Of this powerful bird there are about 13 pairs, which are prized by the natives for their services in keeping down the numbers of the eagles on the cliffs. The landing-place on F. is at a scattered hamlet of wretched thatched huts on the s.e. Here there is a store, at which imported commodities are bartered for fish and other articles, and at which an apartment is let to strangers.

there being no inn. F., however, is rarely visited by strangers, and little is known of it even in Scotland.

FOULD, ACHILLE, was b. in Paris on the 31st of Oct., 1800, and was educated at the Lycée Charlemagne, one of the most celebrated establishments of Paris. He originally belonged to the Jewish creed, his family being wealthy Jew bankers, but he adopted the Protestant faith. Early in life, he was initiated into financial transactions by his father, and his natural talents were developed by travel in Europe and the east. In 1842, he began his political career, being then chosen as a member of the council-general of the Hautes Pyrénées, and immediately after elected a deputy for Tarbes, the chief town of that department. He soon acquired a high position in the chamber of deputies for the peculiar talent with which he handled questions of finance and political economy. In 1844, he was appointed reporter to the commission on stamps on newspapers, and his views were adopted, in spite of the opposition party, he being at that period a stanch supporter of M. Guizot's home and foreign policy. After the revolution of 1848, F. accepted the new régime of the republic, and offered his services to the provisional government. In July, 1848, he was elected representative for the department of the Seine, and continued to rise in public estimation by the elevated views he expressed in the chamber, while opposing among other things a proposed issue of assignats. During the presidency of Louis Napoleon, F. was four times minister of finance, and his repeated resignations for state reasons did not prevent him from being again appointed on the occasion of the *coup d'état*, 2d Dec., 1851. He once more resigned his position on the 25th Jan. following, in consequence of the decree ordering the confiscation of the property of the Orleans family. The same day, however, he was created a senator, and shortly afterwards returned to power as minister of state. In this capacity, he superintended the universal Paris exhibition in 1855, the completion of the palace of the Louvre, and other great measures. He remained one of the most confidential ministers of Napoleon III. till Dec., 1860, when he was succeeded as minister of state by comte Walewsky. He was out of office up to the 14th Nov., 1861, at which date he was reappointed finance minister, his long experience and well-known ability as a financier pointing him out as the man to manage the crisis of the French finances at that time. He died in 1867.

FOUL IN THE FOOT, ulcers and granulation in the feet of sheep, a contagious disease, generally controlled and cured by applications of tarry substances.

FOULIS, ROBERT and ANDREW, two eminent printers of Glasgow, brothers, whose names are usually classed together.—Robert, the elder, born in that city, April 20, 1707, was bred, and, like Allan Ramsay, for some time practiced as a barber—in those days of flowing periwigs, a profitable and respectable profession. Having attended for several years the lectures of the celebrated Dr. Francis Hutcheson, then professor of moral philosophy in Glasgow university, he was advised by that gentleman to become a bookseller. In winter, he and his brother Andrew (born Nov. 23, 1712) employed themselves in teaching languages; and in summer, they made short excursions to the continent, and thereby acquired a considerable amount of learning and knowledge of the world. Andrew seems to have been designed for the church. In 1727, he entered as a student at the university of Glasgow, where he is supposed to have undergone a regular course of study. About the end of 1739, Robert began business in Glasgow as a printer, his first publications being chiefly of a religious nature. In 1742, he published an elegant edition in 4to of *Demetrius Phalereus on Elocution*, supposed to be the first Greek work printed in Glasgow. In 1743, he was appointed printer to the university. In 1744, he brought out his celebrated immaculate edition of Horace, 12mo, each printed sheet of which was hung up in the college of Glasgow, and a reward offered for the discovery of any inaccuracy. Soon after he took his brother Andrew into partnership; and for thirty years they continued to bring out some of the finest specimens of correct and elegant printing, particularly in the Latin and Greek classics, which the 18th c. produced, either in this country or on the continent. Among them were Cicero's works, in 20 volumes; Cæsar's Commentaries, folio; Homer's works, 4 vols.; Herodotus, 9 vols., etc.; also an edition of the Greek Testament; Gray's poems; Pope's works; a folio edition of Milton, and other publications in English. With the view of promoting the cultivation of the fine arts in Scotland, Robert Foulis, after a two years' visit to the continent in preparation, commenced, in 1753, an academy at Glasgow, for the instruction of youth in painting and sculpture. The great expense attending this institution led to the decline of the printing business, which, however, continued to be carried on till the death of Andrew, Sept. 18, 1775. In 1776, Robert exhibited and sold at Christie's, Pall Mall, London, the remainder of his paintings, when, after all expenses were defrayed, the balance in his favor amounted only to 15 shillings. He died the same year at Edinburgh, on his return to Scotland. He was twice married, and left several children. One of them was a printer in Glasgow as late as 1806. His Virgil, printed in 1778, and his Æschylus, 1795, for beauty and exactness, were not unworthy of the name of Foulis.

FOUNDATION. This term may be applied either to the surface or bed on which a building rests, or to the lower part of the building which rests on the natural bed. 1. F. as the bed.—The best that can be had is solid rock, or any kind of resisting incompressible stratum, free from water. Where there is no chance of water, sand

forms a solid foundation. When the soil is soft, loose, and shifting, a solid bearing can be obtained only by driving *piles* or long beams of wood, sharpened at the end, through the soft soil, till they reach a hard bottom. This is then planked or laid with cross-beams, on which the superstructure is built. The piers of many bridges are formed in this manner. Where the soil is soft, but not shifting, as in the case of made or deposited earth, the method of *concreting* (q.v.) is adopted—i.e., a large surface is laid with broken metal or gravel, and run together with hot lime, so as to form a broad solid artificial rock, on which the building may rest. 2. F. as the base of the building.—The broader and larger the lower courses of the mason-work, the stronger the wall. The stones should, if possible, extend through and through, and project on each side of the wall.

In the best periods of art, the foundations have always been most attentively considered. The Romans formed solid bearings of concrete as above described, and paid great attention to secure the stability of their buildings. In the dark ages, when there was want of knowledge combined with want of materials and means, many buildings fell from the yielding of the foundations. Some of the earlier Gothic buildings also suffered from the same cause. But knowledge came with experience, and the foundations of the later Gothic buildings, during the 14th and 15th centuries, were built with extreme care, and on the virgin soil—the stones being as finely dressed as those above ground, where necessary to resist a strong thrust. And where the weight is thrown unequally on piers and walls, these detached points are all carefully united below the floor with a net-work of solid walls.

Bad foundations have been the cause of the ruin of many modern buildings. This has arisen from the costly nature of making a good foundation, when the soil is not naturally suitable. But it is clear that no expense should be spared to make the F. good, as the value and stability of the superstructure depend entirely on the security of the foundation.

FOUNDATION (*ante*), the artificial structure on which the remainder of an edifice rests. The *body* of the foundation is the masonry or timber-work used; the *bed*, the prepared surface on which the body rests. The bed may be a leveled surface of rock, sand, or earth, consolidated by beating or by driving piles into it; if the tops of the piles are bound together by a flooring of timbers—called a grillage—this flooring is deemed the bed of the foundation. Rock is the best foundation, but its bearing power should be tested, and its upper surface should be made normal to the direction of the pressure. To avoid expense, the bearing surface may be left in steps, but the steps should be filled with well-fitted masonry, that there may not be undue settlement upon the filled side, in case the lowest step should be much lower than the highest. Great care should be taken to apportion the load to the supporting power of the foundation; if the latter be found inadequate, the area of the foundation should be increased until the weight distributed to each unit of surface shall be brought within the proper maximum.

Engineering science has been severely tested by demands for sure foundations in places where the soil and substrata are by nature yielding, or exposed to the insidious action of running water, or where both evils are united.

Except upon solid rock, settlement cannot be avoided. It is enough for the safety of the structure if the settlement can be made uniform in all its parts. In some cases, an "area" is made, as under the new capitol at Albany, N. Y. The earth was removed to a proper depth under the whole structure, and the level surface exposed was thoroughly beaten. The surface was then covered with 6 in. of concrete of broken stone and cement, thoroughly grouted; layer after layer was formed, until sufficient thickness was made, and finally the concrete was covered with broad foundation stones, placed so near to each other that the concrete could not rise between the blocks. On this platform the building is erected. If the subsoil be tolerably firm, small blocks will probably find a continuous bearing surface better than large ones, unless care is taken to dress both level; but beds of concrete may be laid, upon which broad stones may be floated before the concrete sets, and perfect contact may be secured. If the ground contain springs of water, the water must be kept from washing out the concrete before it has come to harden. Drains may be made to some point in the work, whence the water may be removed by pumping, or sheet-piling may surround the area, in the manner of a coffer-dam. In England, the foundations of the Rochester bridge were laid in large cylinders filled with masonry; the tide water entered the cylinder, and washed out the concrete; when the tide was out a piece of stout canvas impervious to water was laid in the bottom of the cylinder, the concrete placed upon it, and the water successfully excluded. A yielding soil is frequently consolidated by driving into it timbers called piles. These are trunks of trees, cut as long as may be, sharpened at the smaller end and driven into ground by blows from a heavy iron ram raised and let fall by machinery. A very effective steam pile-driver lately used has the ram joined to the piston of a steam-cylinder; the weight of both ram and cylinder rests on the pile, and the action is so rapid that, after the pile is once started into the earth, it is scarcely allowed to stop until it comes to its final bearing. If piles are driven at distances of, say, 4 ft. between centers, into ground previously loose, the ground must be greatly compressed to make room for so great masses of timber, which also serves to bind the whole mass together. If, farther, the tops of the piles are cut to a common plane, and

cross timbers are securely bolted to the heads of the piles, a very secure platform is constructed upon which great weights properly distributed will sink equably, if at all. Sometimes, after the tops of the piles have been cut to the required level, the earth is removed for 2 or 3 ft. and the space is filled with concrete, the grillage being placed above the concrete.

The custom-house at New Orleans, La., is founded upon a plank floor laid 7 ft. lower than the street pavement. A timber platform lies next, consisting of logs 12 in. in diameter laid side by side, and crossed by other logs leaving spaces of 2 or 3 ft. between them; the spaces are filled with concrete, and the platform is covered with a foot of concrete; the walls rest upon inverted arches, the whole area beneath the building, about 300 ft. square, being thus utilized in supporting the structure above. During the first three years, the building sank an average of 19.1 in.; after sixteen years, the difference in the levels of the walls was 8 inches. Foundations are often laid below the surface of water by means of a coffer-dam. To form a coffer-dam a row of piles is driven inclosing the space which the foundation is to occupy, and their tops are bound together by a continuous cap of heavy timber. A parallel row of planks, called sheet piles, is driven with their edges in contact if possible, and the tops are firmly bound to the frame first formed. A second row of large piles, capped, and faced with sheet piles like the first, is driven so as to leave a space of 5 to 20 ft. between the two linings of sheet piles, which face each other. This space is filled with layers of clay thoroughly packed and puddled together, forming a strong dam quite impervious to water. The water inclosed by the dam is pumped away, and the ground is open for the reception of a foundation. It sometimes happens that the bed of the stream is rock, covered with a stratum of mud or earth too thin to support piles, and too porous for sustaining a coffer-dam. A caisson has sometimes been used in such cases. This is a chest, or water-tight box, large enough to receive the intended foundation. The lower courses may be laid in the box, the whole floated to its proper place, and there sunk. The bed of the stream should be nearly level for the reception of the chest; or the mud may be removed by dredging and the caisson be lowered into the cavity so formed; the water will then be likely to wash about the chest more mud or gravel, which will assist in keeping it in place. The water may then be removed from the interior of the caisson and the foundation be built up.

A method of laying foundations in deep water adopted in late years is called the "pneumatic;" the manner of its application is either that of a "vacuum" or a "plenum," according as the pressure of the air within is below or above the usual pressure of the atmosphere. In either case, an iron cylinder, usually constructed in sections, is lowered into the water until its lower end rests on the bottom, while its upper end extends above the surface. If the vacuum process be used, the cylinder is capped, and an air-pump reduces the pressure of the air within. The weight of the tube with the atmospheric pressure on its head, pushes it into the ground, while the water pressing in below the lower end stirs the earth and assists the descent. When descent stops, the air-pump may be reversed, and the water in the pipe will be slowly driven through the earth; a sudden release of the inner pressure will cause a second influx of water, a disturbance of the soil, and a farther descent of the tube. If the earth contains boulders or buried timbers, the movement of the tube may be stopped before reaching the depth desired by the engineer; or he may wish to remove the interior earth and replace it with masonry, even where the ground is too gravelly to keep out the water. In this case an air-lock is placed upon the top of the tube, air is forced into the interior, driving out the water, and workmen are employed within to excavate the earth, and afterward to lay the masonry. The air-lock is a chamber which serves as a vestibule to the interior, and permits the maintenance of a nearly constant air-pressure within. A man enters the air-lock and closes the door behind him; he then opens communication with the interior of the tube, and when the pressure of air is equalized in the two spaces he passes within. In the Harlem bridge at New York the tubes of the pier were 6 ft. in diameter, in sections 10 ft. long; the air-lock was 6 ft. long; the man-holes were 20 in. in diameter. Compressed air was stored in a reservoir upon shore, and was communicated to the tube by a flexible pipe; the flow of air was regulated by a stop-cock. Stop-cocks permitted the discharge of the air into the water at times, thus assisting the tube to sink into the earth. It was found farther that the air-pressure would force sand from the bottom of the tube up through a pipe above the surface of the water, greatly facilitating the labor of excavation and lifting. The tube, while sinking, is liable to incline from the vertical; this has been opposed by placing wedges under the too-rapidly sinking edge; by boring holes on the upper or retarded side of the tubes, that the issuing air may disturb the earth, and permit a more rapid movement of the tube; the most effective remedy has been the beating of the upper end of the tube with a heavy ram; the jar seemed to loosen the soil. The pneumatic caisson is a further development of the pneumatic process. In the method described, the tube is first placed, and the interior masonry afterwards inserted; but when the caisson is used the masonry is built upward while the pier is sunk downward, and the weight serves to force the whole into the soil. The lower part is a structure of iron having walls and a roof; the walls are strong enough to sustain the lateral pressure of the water and earth, and the roof is able to carry the load of masonry which may be piled upon it. The lower edge of the wall is

so thin that it may be easily forced into the soil. From the lower portion tubes rise to form a communication between the caisson and the air-chambers above the water, and to afford a passage for the workmen and for raising material. The air-locks may be at the tops of the tubes, but better practice places them at the bottom, just above the caisson. The foundations of the Tay bridge, celebrated first for the splendid engineering achievements of its construction, and later for the utter destruction of its fall, were laid by this method. Each pier consisted of two columns of masonry, so joined at the bottom as to form one large compartment under the pier. At first single columns were sunk separately, but their bases were too narrow, and they were overturned before they were finished. The lowest chamber of the caisson was 22 ft. 7 in. long, 10 ft. 6 in. wide, and 3 ft. high. It was surmounted by a conical frame 5 ft. high, partially closed at the top by a flange 2½ ft. wide, upon which the masonry rested. The bodies of the cylinders were of cast-iron, ¾ of an inch thick, 9½ ft. in diameter, and in sections about 4 ft. high. The lowest section was so formed that the two columns were joined by masonry arched over the central part of the caisson. A space of about 2 in. wide, left between the masonry and the iron, was afterward filled with concrete. After the pier was lowered to a permanent position the lower chamber was filled with concrete, and finally the cylindrical interior passage was filled. The piers were partly built near the shore, being supported by pontoons, and at a proper stage of the tide were floated into place, and carefully lowered by the aid of hydraulic power.

Each of the piers and abutments of the bridge over the Mississippi at St. Louis was built in a large caisson, having one large air-space in the base, where the workmen excavated the sand. The base compartment was 9 ft. high, the sides being, for the large pier, ¾ of an inch thick, ⅝ in. in the smaller. Massive cross partitions of timber were built to sustain the roof of the chamber upon which the masonry was placed. There were three shafts, each connected with the air chamber by an air-lock placed below the masonry, where it would not have to be moved as the sinking proceeded. The support given by the timbers which rested on the bottom, the friction on the sides of the caisson, and the buoyancy of the air were the means relied on to sustain the pier in its descent to the bed-rock. When the rock was reached it was 110 ft. below the surface of the water. Doubts had been raised whether the workmen could endure the increase of ordinary atmospheric pressure to 4½ atmospheres, but danger was avoided by frequent changes; so that men were not kept in the compressed air for more than an hour at one time. Exposure to intense pressure for several hours produces paralysis, and in some instances death. All combustible articles burn vigorously in the compressed air, even woolen cloth being extinguished with difficulty. The lamps were inclosed in very strong glass cases, which communicated with the open air, and allowed the combustion to act under ordinary pressure. When the rock was uncovered its depressions were filled with concrete, continued up the sides of the caisson to prevent the water from washing it; the central mass was filled nearly full of wet sand, and concrete was rammed between the sand and the roof. The sand was used to avoid cost, and was supposed to be as good in its place as cement.

The foundations of the piers of the East river bridge, to connect New York and Brooklyn, were built upon caissons and sunk by the pneumatic process. The Brooklyn caisson is 168 ft. by 102 ft.; the New York caisson, 172 by 102. The Brooklyn pier rests on a firm subsoil at the depth of 50 ft. below the surface of the water; the New York pier rests on a compact layer 2 or 3 ft. above the bed-rock at the depth of 78 feet.

FOUNDER, also called LAMINITIS, consists of inflammation of the vascular sensitive laminæ of the horse's foot. It is rarely met with in cattle or sheep, owing to the corresponding structures being in them greatly less developed. Occasionally, the laminæ are strained from severe exertion; more frequently, they suffer from the morbid effects of cold, which is especially injurious after the excitement and exhaustion of labor. Very commonly, also, they become inflamed from their close sympathy with diseases of the digestive organs, often following engorgement of the stomach, or inflammation of the bowels. All four feet are sometimes affected, more usually the fore ones only. They are hot and tender; the animal stands as much as possible upon his heels; trembles and groans when moved; and is in a state of acute fever and pain. Except when following superpurgation or internal disease, bleeding is useful. The shoes must at once be removed, and the toes, if long, reduced, but no further rasping or cutting is permissible. The feet must be enveloped in hot bran poultices, and kept off the hard ground by a plentiful supply of short litter. Soap and water clysters, repeated if necessary every hour, usually suffice to open the bowels, which are very irritable, and physic, if required, must therefore be used with extreme caution. Two drams of aloes is an ample dose in founder. Have the strain taken off the inflamed laminæ by getting the animal, if possible, to lie down, or, where this is impracticable, by slinging him. When the inflammation continues so long that serum and lymph are poured out between the sensitive and horny laminæ, they must have free exit provided, by making an opening through the toe with a small drawing-knife. This may prevent the *pumiced* and disfigured feet that are apt to follow severe and repeated attacks. After the acute symptoms pass, cold applications to the feet, and a mild blister round the coronet, help to restore the parts to their natural condition.

FOUNDING, or METAL-CASTING, is the art of obtaining casts of any desired object by means of pouring melted metal into molds prepared for the purpose. It has risen to great importance in recent times, on account of the many new applications of iron. Iron-founding, brass-founding, type-founding, as well as casting in bronze and zinc, are the principal divisions of the art. The casting of the finer metals and alloys, as gold, silver, and German silver, is necessarily conducted on a smaller scale.

When the casting of an object is required, it is necessary, in the first place, to make a pattern. Suppose it to be a plain round iron pillar, such as is used for hanging a gate upon. A pattern of this is turned in some wood which can be readily made smooth on the surface, such as pine, and then varnished or painted so as to come freely out of the mold. This wooden pillar, or any similar pattern, is always made in at least two pieces, the division being lengthwise, for a reason which we shall presently see. The next step is to prepare the mold. The molds used by the iron-founder are either of sand or loam, but more generally of fine sand. Proceeding with the preparation of the mold, the founder takes a molding-box, which is composed of two open iron frames with cross-bars, the one fitting exactly on the other, by means of pins in the upper, dropping into holes in the lower frame. One half of the box is first filled with damp sand, and the pattern laid upon it, a little dry *parting sand* being sprinkled on the surface. The upper half of the box is then put on, and sand firmly rammed all round the pattern. The box is then carefully opened, and, when the pattern is removed, its impression is left in the sand. The mold at this stage, however, is generally rough and broken. It is necessary, therefore, to give it a better finish, which is done by taking each half of the mold separately, repairing it with a small trowel, and reintroducing the corresponding half of the pattern till the impression is firm and perfect. Finally, the surface of the mold is coated with charcoal-dust, which gives a smooth surface to the future casting. These columns being made hollow, there is yet another matter to arrange before the casting can be made—namely, the *core*. In the instance before us, it would simply be a rod of iron, covered with straw and loam to whatever thickness the internal diameter of the column happened to require. The core of course occupies the center of the mold.

The cast iron is melted with coke in a round fire-brick furnace, called a *cupola*, the heat being urged by means of a powerful blast, created by fanners revolving at a high speed. The molten metal is run from a tap at the bottom of the furnace into a malleable iron ladle, lined with clay, from which it is poured into the mold through holes called *runners* or *gates*. When the mold is newly filled, numerous jets of blue flame issue from as many small holes pierced in the sand. These perforations are necessary for the escape of air and other gases produced by the action of the hot metal on the mold. Care must also be taken not to have the mold too damp, otherwise steam is generated, which may cause holes in the casting, and even force part of the metal out of the mold. The casting remains covered up for a time, in order to cool slowly, and is then removed by breaking away the sand, and drawing out the core.

In the case of a fluted, or otherwise ornamented pillar, the pattern would require to be in at least four pieces instead of two, because it is only a plain pattern that will come out of the mold in halves without tearing away the sand. When a pattern is necessarily made in several pieces, it is drawn out of the mold bit by bit, to the right or left, as the case may be, and so parts from the sand without breaking it.

Suppose that a small ornamental vase was to surmount the pillar, the founder would prepare the pattern of this in a more elaborate manner. He would first mold it in wax or clay, from which a cast in plaster of Paris is made; from that, again, a cast is taken in an alloy of tin and lead, which, after being sharply chased, and divided into the required number of pieces, is used as a pattern to cast from. All ornamental patterns, such as figures, scrolls, leaves, enriched moldings, and the like, are made in this way, whatever metal the ultimate casting is to be produced in.

Very large engine cylinders, pans, and such vessels, are cast in loam-molds, which are built of brick, plastered with loam, then coated with coal-dust, and finally dried by means of a fire. This method is adopted with large plain objects, where a pattern would be expensive, and when few castings of one kind are required.

Iron molds, coated with blacklead or plumbago, have recently been introduced for casting pipes into; they are greatly more expensive than any other kind, but they enable the founder to dispense with a pattern, as, when once made into the required form, they are not destroyed like molds of sand or loam at each casting.

Bronze and brass are cast in molds prepared with finer sand than that used for iron. Pewter and similar soft metallic alloys are cast in brass molds. The type-founder, on the other hand, uses molds of steel, which are now worked to a great extent by a machine.

The variety of articles produced by F. or casting are very numerous, among others we may mention cylinders, cisterns, paper-engines, beams, boilers, pumps, and the heavy parts of machinery generally, gates, railings, lamps, grates, fenders, cooking-vessels, and the like, in iron: cannon, many portions of machinery, and numerous ornamental objects, in brass: sculpture and other works of art in bronze and the more costly metals. One of the most remarkable castings yet executed for the requirements of modern engineering, was the cylinder of the hydraulic press used for raising the tubes

of the Britannia bridge. It measured 9 ft. × 3 ft. 6 in., the metal being 10 in. thick, and weighed upwards of 20 tons. It remained red hot for three days, and it was seven days more before men could approach it to remove the sand. Sole plates for steam-hammers, and for other purposes, have been cast more than double this weight, but the same care was not required in their execution. In regard to sculpture, perhaps the most wonderful casting known is the colossal statue of Bavaria at Munich, finished in 1850, which stands 54 ft. high, the face being equal to the height of a man. It took eight years to cast, and the cost of the bronze used was about £10,000.

FOUNDLING HOSPITALS, establishments in which children that have been abandoned by their parents and found by others, are nurtured at the public expense. Amongst the ancient nations, these institutions were not unknown, though as the law usually placed the power of life and death in the hands of the father, and permitted him to sell his children into slavery, it is to be feared that infanticide, as among eastern nations at the present day, was the usual mode of solving the difficulty which F. H. are intended to meet. Desertion, however, and exposure as less atrocious, were still more frequent crimes; and to meet these, the reception and education of foundlings were enjoined on private persons, to whom they were assigned in property. When this means of support failed, they were protected by the state. The Egyptians and Thebans are praised by the classical historians for discouraging the exposure of infants. The practice of exposing infants probably prevailed even amongst the Germanic nations previous to the introduction of Christianity; and though Tacitus says that infanticide was forbidden, in Iceland, in particular, it is said to have reached a fearful height. From the period at which Christianity became the state religion of the Roman empire, a sensible change in the spirit of legislation on the subjects both of infanticide and exposure is apparent; and though the latter is spoken of by Gibbon as one of the most stubborn remnants of heathendom, it gradually gave way, and the Christian church, at a very early period, lent its encouragement to the establishment of F. H. So early as the 6th c., a species of foundling hospital is said to have existed at Treves. The bishop permitted the children to be deposited in a marble basin which stood before the cathedral, and gave them in charge to members of the church. But the first well-authenticated one is that of Milan, established in 787, probably in obedience to the 70th article of the council of Nice, which enjoined that a house should be established in each town for the reception of children abandoned by their parents. It is probable, however, that F. H. existed pretty extensively at an earlier period, as mention is made of them in the capitularies of the Frankish kings. In 1070, a foundling hospital was established in Montpellier; in 1200, in Eimbeck; in 1212, in Rome; in Florence, in 1317; in Nürnberg, in 1331; in Paris, in 1362; in Vienna, in 1380. In France, the utility of these establishments, which were the special labor of Vincent de Paul (q.v.), was early called in question; and letters-patent of Charles VII., in 1445, affirmed that "many persons would make less difficulty in abandoning themselves to sin when they saw that they were not to have the charge of the upbringing of their infants." In Germany, the system of F. H. was soon abandoned, the duty of rearing the children being, as in England, imposed by law, first on the parents, then on more distant relatives, whom failing, on the parish, and last of all, on the state. The reproach made by Roman Catholic countries against this more natural arrangement—that it tends to promote infanticide—is said to have been in no degree established by statistical investigations. The revolutionary government of France not only adopted the system of F. H., as it had been handed down to it, but in 1790 declared all children found to be children of the state (*enfants de la patrie*). Nay, as a still further premium on immorality, it declared that every girl who should declare her pregnancy should receive a premium of 120 francs! The imperial government, in 1811, abolished this insane enactment, but continued and further systematized the arrangement by which the F. H. had become government establishments, and the children, children of the state. This state of things remained unaltered till recently, and every considerable town had its foundling hospital and turning-wheel. The expense of rearing a child to the age of twelve in the hospital at Paris was computed at 952 francs 42 centimes, or a trifle less than £40. The moment that the child was received it was weighed, and if its weight was less than six pounds, it was considered that its chance to live was very small. It was then inscribed in a register, and a formal statement was drawn up of any name which had been given along with it, or of any particular mark which it bore either on its person or otherwise; of the hour at which it was deposited, its sex, and its dress. It was then inspected by a medical man, and handed over to the nurses. At Paris, each child was committed to a special nurse, many of whom were retained on the premises, and paid 40 centimes a day. Other nurses were brought in from the country in carriages kept by the hospital, which returned conveying the children along with their new mothers. The children thus boarded out were inspected twice a year by local medical men appointed for the purpose. The parents and relations were permitted to reclaim them at any period, or they might be legally adopted by any French citizen in a condition to maintain them. A large proportion of the children were not proper foundlings, but orphans and infants abandoned by parents unable or unwilling to bear the expense of their maintenance; and the mothers were known in many instances by offering themselves as nurses to get charge of their own infants. The question of the propriety of

encouraging secrecy by the use of the turning-box, or of causing the parents openly to deposit the children in the hands of an officer, was long discussed with much keenness in France. The argument in favor of the turning-box was that by which the whole institution was defended, viz., that it tended to discourage infanticide. But even if that were unquestionable, there were many other obvious considerations to be taken into account, and these have preponderated. An official report by M. Gasparin, in 1837, showed that the number of children exposed had increased between 1811 and 1833, from 70,000 to 130,000; that the infant mortality was appalling; and that those who survived, ushered into the world without friends or means, constituted a large proportion of the thieves and prostitutes of the country. Within the last thirty years the whole system has been greatly modified, the changes being in the direction recommended in M. Gasparin's report. A large number of hospitals have been suppressed. The turning-box has been abolished, or, where retained, placed under such restrictions as make the abandonment public; the officers of the hospital, on receiving the infants, make full inquiry into the position and residence of the mother. The new-born infants have a separate department assigned them, and assistance is given at their own dwellings to mothers in circumstances to require it. The very name of "enfans trouvés" has been exchanged for "enfans assistés." The result has been a vast diminution of the number of exposures, and a great saving of expense to the country, and lessening of mortality among the infants. The present number of F. H. in France is believed to be about 130. In Spain they number about 70. Portugal, Belgium, Austria, and Norway possess F. H.; and those of Moscow and St. Petersburg are among the largest in the world.

The foundling hospital in London was established by capt. Thomas Coram, a benevolent sailor, in 1739, as "an hospital for exposed and deserted children." The ground in Guildford street was purchased from the earl of Salisbury for £7,000, and the architect of the hospital was Theodore Jacobson. The system of F. H. never having been approved in England, the London hospital was changed in 1760 to what it now is—viz., an hospital for poor illegitimate children whose mothers are known. The committee, previous to admitting the child, must be satisfied of the previous good character and present necessity of the mother. The qualification for a governor is a donation of £50. The great Handel was one of the chief benefactors of the hospital. He endowed it with a magnificent organ, and frequently performed his oratorio of the *Messiah* in the chapel, which is still celebrated for its music. Though every attention is paid to the health and comfort of the children at the foundling—to such an extent, indeed, as very often to unfit them for the hardships which many of them must encounter in after-life—we have been informed by the physician that they do not attain to the height of average English men and women. F. H. exist in Mexico, and in almost all the states of South America; in the United States there are few, and these mainly supported by private charity.

FOUNDLING HOSPITALS (*ante*) are intended to save children from death by exposure, and it is therefore difficult to describe them properly apart from the general subject of infanticide, a practice extremely common among nearly all ancient nations. It may still be studied in such horrible institutions of savage life as the Areoi of the Society islands, or the Meebra of New South Wales; and it may be found in the greatest variety of form among the tribes of Hindustan. The motives which suggested the practice were sometimes superstitious; more often extremely practical. The natives of Gujarat said to maj. Walker, "pay our daughters' marriage portions and they shall live." The feeling here was one of social dignity, mixed with the strong contempt which many savages express for the unmarried state. But in most cases, children were killed simply because the parents, having no realized wealth, did not expect to be able to clothe and feed them. This is especially seen in the frequent killing of female children and those who are sick and deformed. In some places, the practice has been confined to the children of concubines, of stranger fathers, or of mothers dying from sickness. In the earliest society, the right to kill belonged to the father, sometimes assisted by a person skilled in omens, or by a council of friends. But the usage soon hardened into a binding custom or into express laws. Thus, in the exogamous communities, girls were clearly a source, not of weakness only, but also of danger. At a much later period, the number of a family, or of the daughters, was often fixed by law, and both Lycurgus and the Roman decemvirs directed the slaughter of deformed children. This violence to the domestic affections was probably made easier by the notion, which appears in Greek science and in Roman law, that neither the fetus nor the newly born child is entitled to the privilege of humanity. The Greek pastoral of Longus and the Self-Tormentor of Terence, show still better than the text of laws how the conscience of a civilized society reconciled itself to such cruelties. And the sober reasoning of Aristotle goes even beyond the custom of his time. Pliny the elder defends infanticide as a necessary check on population, and Quintilian and Seneca bear witness to the frightful mortality among children exposed, and the systematic mutilation of those who survive. The legislation of Constantine did not go beyond a declaration that the killing of a son was equal to parricide; but the famous law of Valentinian, Valens, and Gratian punished exposure by the loss of the *patria potestas*, and secured the rights of the foster-father.

Finally, Justinian declared that the foundling should no longer be the slave of the foster-father, but should be free. This, however, did not affect Western Europe, where social disorder and the recurrence of famine led to extensive sales of children. Against this evil, which was noticed by several councils, the church provided a rough system of relief, children being deposited in marble shells at the church doors, and tended first by male nurses and then by the foster-parents. Nothing is known of the *brephotrophia*, which are said to have existed in the eastern empire at this time, nor of the public tables which particular emperors are said to have provided for the support of children. The earlier traditions of a hospital at the Cynosarges in Athens, and at the Columna Lactria in the vegetable market at Rome are disputed. It was in the 7th or 8th c. that institutions for foundlings were definitely established in such towns as Treves, Milan, and Montpellier. In the 15th c., Garcias, archbishop of Valentia, was a conspicuous figure in this charitable work; but his fame is entirely eclipsed by that of St. Vincent de Paul, who in the reign of Louis XIII., with the help of the countess of Joigny, Mme. le Gras, and other religious ladies, rescued the foundlings of Paris from the horrors of a primitive institution named La Couche, and ultimately obtained from Louis XIV. the use of the Bicetre for their accommodation. Letters patent were granted to the Paris hospital in 1670. The Hotel-Dieu was the next in importance. No provision, however, was made outside of the great towns; the asylums in the cities were overcrowded and administered with laxity; and in 1784, Necker prophesied that the state would yet be seriously embarrassed by this increasing evil. From 1452 to 1789, the law had imposed on the *seigneurs de haut justice* the duty of succoring children found deserted on their territories. The first constitutions of the revolution undertook as a state debt the support of every foundling. For a time premiums were given to the mothers of illegitimate children, the "children of the nation." At the present time, all the countries of Europe, except Scotland, are provided with foundling hospitals, and there are several such institutions in China. They are also frequent in various countries—in America, in Mexico, Brazil, and Canada. The foundling hospital of the sisters of charity, in New York city, was established in 1869, the city giving the site and $100,000 towards its foundation. It began operations in Oct., 1869, and in four years received 5,076 infants, of whom 2,037 died. A box was placed every night for the receipt of children, and in the first month 29 infants were taken in, many of them less than three hours old. With a single exception, they were accompanied with memoranda giving the name and date of birth. In the same institution, accommodations are afforded for indigent mothers having young infants. Another institution of the kind is the infants' hospital, under the care of the city. Still another is the nursery and child's hospital, founded in 1854; to which may be added the New York infant asylum. Within the past ten years great interest has been manifested in the protection and health not only of the foundlings, but of other children whose parents or guardians neglect or are unable to support them. There is a society for the prevention of cruelty to children, organized in 1375, which has done much good work; and there are homes and seaside sanitariums for the care of the indigent and the sick. [Condensed from *Encyc. Brit.*, 9th ed.]

FOUNTAIN, a co. in w. Indiana, on the Wabash river; traversed by the Wabash and Erie canal, the Indianapolis, Bloomington and Western, and the Wabash railroads; 400 sq.m.; pop. '70, 16,389. The surface is level, much of it yet covered with forests, the sugar maple being plentiful. Coal and iron are found in abundance. The principal agricultural productions are wheat, oats, corn, butter, and wool. Co. seat, Covington.

FOUNTAIN, a basin or jet for the supply of fresh running water. There are fountains of every form and variety, from the simple spring with its natural basin, to the most elaborate and ornamental structure for the display or supply of water. In all ages, fountains have been considered as public monuments of the greatest importance; and where the source for their supply has not been provided by nature on the spot, immense labor and expenditure have often been incurred to make up for the deficiency. The splendid aqueducts (q.v.) of the Romans are instances of the important light in which they regarded the fountains of their cities. Every Roman town had at least one aqueduct, the water from which was distributed to as many fountains as the population required.

Utility is the first object of a fountain and although they are frequently made subjects of great display and magnificence, the finest fountains are those where the water is the greatest ornament. In the middle ages, fountains of great beauty and variety of form were built, but the useful nature of the structure was never lost sight of. Sometimes a spring was arched over for protection, with a beautiful vault, and a statue of the patron saint placed in a niche, with a basin below to contain the water. In towns where a number of persons might require to draw at one time, a large basin was erected, with a pillar in the center, from which pipes radiated all round—each with its separate jet to supply the running water—while the basin was used for washing the pitchers. Many examples of this kind of F. remain. The pillar is sometimes surmounted by a statue, or has one or more smaller basins, with ornamental streams and jets of water falling from tier to tier. A beautiful F. of this nature existed in the royal palace at Linlithgow, and a copy of it has been erected in front of Holyrood palace.

In modern times, the French have distinguished themselves by their magnificent

fountains, those of Paris and Versailles being almost unrivaled. In England, the fountains at Chatsworth (q.v.) and those at the Crystal palace are among the finest, and are remarkable for the great height to which the water is thrown. Although Rome has lost four fifths of the aqueducts which so lavishly supplied her with fresh water in the times of the empire, she is still unsurpassed for the number, beauty, and utility of the public fountains which adorn her streets and places.

Modern fountains are, for the most part, entirely ornamental. This arises from the modern mode of distributing water in pipes through the houses, making the street-fountains to a great extent useless. It is found, however, that our town populations—both man and beast—require some public supplies of water, and these are now largely supplied by the numerous drinking-fountains which are being constructed in all our principal towns.

FOUNTAIN (*ante*), a spring of water. The term is applied in a restricted sense to such springs as, whether fed by natural or artificial means, have arrangements of human art at a point where the water emerges. Pure water is necessary to man; and the degree of plenty, constancy, and purity in which it is procured, transported, prepared for use, and distributed in populous districts is so fair a standard of civilization, that it seems not unreasonable in Pausanias to put it among the criteria, asking, with reference to Panopæus, if that can be rightly called a city which has neither ruler, gymnasium, forum, nor fountain of water. Among the Greeks we learn, mainly from Pausanias, that fountains were very common in the cities; and springs being very plentiful in Greece, little engineering skill was required to convey the water from place to place. Receptacles of sufficient size were made for it at the springs; and to maintain its purity, structures were raised inclosing and covering the receptacle. It is not surprising that so beneficent an object as a spring of water should be connected with religious belief. It is certain that until modern times fountains have been in some way connected with the religion of the people among whom they sprang, and dedicated to one or other of its personalities. In Greece, they were dedicated to gods and goddesses, nymphs and heroes, and were frequently placed in or near temples. The references to fountains by Pausanias are frequent, but he gives no full descriptions. That of Pirene at Corinth (mentioned also by Herodotus) was formed of white stone, and contained a number of cells from which the pleasant water flowed into an open basin. Legend connects it with the nymph Pirene, who shed such copious tears, when bewailing her son who had been slain by Diana, that she was changed into a fountain. The city of Corinth possessed many fountains. In one near the statues of Diana and Bellerophon, the water flowed through the hoofs of the horse Pegasus. The fountain of Glauce, inclosed in the Odeum, was dedicated to Glauce because she was said to have thrown herself therein, believing that its waters could counteract the poisons of Media. Another Corinthian fountain had a bronze statue of Neptune standing on a dolphin from which the water flowed. The fountain constructed by Theagenes at Megara was remarkable for its size and decorations, and for the number of its columns. One at Lerna was surrounded with pillars, and the structure contained a number of seats affording a cool summer retreat. Near Pharæ was a grove dedicated to Apollo, and in it a fountain of water. Pausanias gives a definite architectural detail when he says that a fountain at Patræ was reached from without by descending steps. Mystical, medicinal, surgical, and other qualities, as well as supernatural origin, were ascribed to fountains. One at Cyanæ, near Lycia, was said to possess the qualities of endowing all persons descending into it with power to see whatever they desired to see; while the legends of fountains and other waters of strange powers to heal are numerous in many lands. The fountain Enneacrunus at Athens was called Callirrhoe before the time the water was drawn from it by the nine pipes from which it took its later name. Two temples were above it, according to Pausanias, one dedicated to Demeter and Proserpine, and the other to Triptolemus. The fountain in the temple of Erechtheus, at Athens, was supplied by a spring of salt water, and a similar spring supplied that in the temple of Roseidon Hippias at Mantinea.

Though no doubt most tribes of other than nomadic habits of life must have contrived, in their settlements, appliances of some kind for maintaining the supply of water constant and pure, very few remains of these have been found that possess any degree of architectural importance. Layard mentions an Assyrian fountain, found by him in a gorge of the river Gomel, which consists of a series of basins cut in the solid rock, and descending in steps to the stream. The water had been originally led from one to the other by small conduits, the lowest of which was ornamented by two rampart lions in relief. The water-supply of Rome and the works auxiliary to it were on a scale to be expected from a people of such great practical power. The remains of the aqueducts which stretched from the city across the Campagna are amongst the most striking monuments of Italy. Vitruvius gives minute particulars concerning the methods to be employed for the discovery, testing, and distribution of water, and describes the properties of different waters with great care, proving the importance which was attached to these matters by the Romans. The aqueducts supplied the baths and the public fountains, from which last all the populace, except such as could afford to pay for a separate pipe to their houses, obtained their water. These fountains were there-

fore of large size and numerous. They were formed at many of the castella of the aqueducts. According to Vitruvius, each castellum should have three pipes—one for public fountains, one for baths, and a third for private houses. Considerable revenue was drawn from the possessors of private water-pipes. The Roman fountains were generally decorated with figures and heads. Fountains were often also the ornament of Roman villas and country-houses; the water generally fell from above into a large marble basin, with at times a second fall into a still lower receptacle. To the remains of Pompeii we are indebted for much exact knowledge of Roman antiquity in its minutest particulars; and not the least interesting of the disinterred forms are those of the public and private fountains which the city possessed. Two adjacent houses in Pompeii had very remarkable fountains. One, says Gell, "is covered with a sort of mosaic consisting of vitrified tesseræ of different colors, but in which blue predominates. These are sometimes arranged in not inelegant patterns, and the grand division as well as the borders are entirely formed and ornamented with real sea-shells, neither calcined by the heat of the eruption nor changed by the lapse of so many centuries." Cicero had, at his villa at Formiæ, a fountain which was decorated with marine shells. Fountains were very common in the open spaces and at the crossways in Pompeii. They were supplied with leaden pipes from the reservoirs, and had little ornament except a human or animal head, from the mouth of which it was arranged that the water should issue. Not only did simple running fountains exist, but the remains of *jets d'eau* have been found; and a drawing exists representing a vase with a double jet of water, standing on a pedestal placed in what is supposed to have been the impluvium of a house. There was also a *jet d'eau* at the eastern end of the peristyle of the Fullonica at Pompeii.

As among the Greeks, so with the early Celts, traces of superstitious beliefs and usages with relation to fountains can be traced in monumental and legendary remains. At Lochrist, beneath the church, and at the foot of the hill upon which it is built, is a sacred fountain, near which is erected an ancient chapel, which, with its ivy-covered walls, has a most romantic appearance. A Gothic vault protects this fountain. Miraculous virtues are yet attributed to its water, and on certain days the country people still come with offerings to draw it. In the enchanted forest of Brochelande, so famous from its connection with Merlin, was the fountain of Baranton, which was said to possess miraculous characteristics. The Christian missionaries could not easily overcome beliefs so planted in the hearts of the people, and so strengthened by daily practices. By a wise stroke, whether of policy or instinct, finding themselves unable to eradicate the superstitions which ascribed miraculous power to rocks and woods, streams and fountains, and connected them with the divinities of the old religions, they changed their form and direction by dedicating these objects to the Virgin and to saints, so making the force of the old belief an instrument for its own overthrow. Fountains were attached to the new religion by the erection of statues of the Virgin or of saints upon the possibly rude structures that collected the water and preserved its purity. There is some uniformity in the architectural characteristics of these structures during the middle ages. A very common form in rural districts was that in which the fountain was reached by descending steps (*fontaine grotte*). A large basin received the water, sometimes from a spout, but often from the spring itself. This basin was covered by a sort of porch or vault, with, at times, molded arches and sculptured figures and escutcheons. On the bank of the Clain, at Poictiers, is a fountain of this kind, the fontaine Joubert, which, though restored in 1597, was originally a structure of the 14th century. Many such fountains are found in Brittany, and indeed throughout France, and the great antiquity of some of them is proved by the superstitions regarding them which still exist among the peasantry. A form more common in populous districts was that of a large open basin, round, square, polygonal, or lobed in form, with a columnar structure at the center, from the lower part of which it was arranged that spouts should issue, playing into an open basin, and supplying vessels brought for the purpose in the cleanest and quickest manner. The columns take very various forms, from that of a simple regular geometrical solid, with only grotesque masks at the spouts, to that of an elaborate and ornate Gothic structure, with figures of virgins, saints, and warriors, with moldings, arches, crockets, and finials. In the public market-place at Brunswick is a fountain of the 15th c., of which the central structure is made of bronze. Except in Italy, few fountains are of earlier date than the 14th century. The decay of architectural taste in the later centuries is shown by the fountain of Limoges. It is in form a rock representing Mt. Parnassus, upon which are carved in relief Apollo, the horse Pegasus, Philosophy, and the Nine Muses. At the top, Apollo, in 16th c. costume, plays a harp. Rocks, grass, and sheep fill up the scene.

Public drinking fountains in towns and villages are now very common. In the east, they are a very important institution. In Cairo alone, there are 300. These "sebeels" are not only to be seen in the cities, but are plentiful in the fields and villages, and the great number of them endowed for the gratuitous supply of water to the passengers is referred to by Lane as proving the possession by the Egyptians of a benevolent and charitable character.

Purely ornamental fountains and *jets d'eau* are found in or near many large cities, royal palaces, and private seats. The fontana di Trevi, at Rome, is very large and very celebrated, but, from an artistic point of view, almost as bad work as could possibly be

conceived. It was erected early in the last century under pope Clement XII., and has all the characteristics of decadence. La Fontana Paolina, and those in the piazza of St. Peter's, are perhaps next in celebrity to that of Trevi, and certainly in better taste. At Paris, the fontaine des Innocens (the earliest) and those of the place Royal, of the Champs Elysees, and of the place de la Concorde are the most noticeable. The fountain of the lions and other fountains in the Alhambra palace are, with their surroundings, a very magnificent sight. The largest *jets d'eau* are those at Versailles, at the Sydenham crystal palace, and at San Ildefonso. With the exception of the last, these are supplied from artificial elevated reservoirs.

Artificial fountains are not abundant in American cities, yet there are some in the parks and squares of New York, and other places, that are occasionally in action, though generally dry. Within recent years drinking fountains for men and animals have been put up liberally in the chief cities, some of which are designed with elaborate art, and decorated with admirable taste. Usually, these are the gifts of private individuals. [Largely from *Encyc. Brit.*, 9th ed.]

FOUNTAIN. Water is represented heraldically by a round ball, having wavy stripes of blue and white, barways, called a fountain.

FOUQUÉ, FRIEDRICH HEINRICH KARL, Baron de LA MOTTE, a modern German author, was grandson of the Prussian gen. of this name, distinguished in the seven years' war. Born at Brandenburg, 12th Feb., 1777, F. served as Prussian officer in the campaigns of 1792 and 1813. The interval between these campaigns was devoted to literary pursuits in the country, and the rest of his life was spent alternately in Paris and on his estate at Nennhausen, and subsequently at Halle. He died in Berlin, 23d Jan., 1843. F. appeared first under the name Pellegrin, as translator of Cervantes's *Numancia*, and author of some effusions in the spirit of Spanish poetry. But the Norse legends and old German poetry attracted him most strongly; this was evinced in numerous romances, in prose and verse, which picture the old life of mediæval Europe. Among the best known of these are *Sigurd, der Schlangentödter* (1809)—the first work to which F. attached his real name—*Der Zauberring; Die Fahrten Thiodolf's;* and *Undine* Successful in exhibiting many of the beauties of the romantic school, he is yet chargeable with all its extravagances. Straining too often after fantastically unnatural conceits, he seems fascinated by the antique life which he pictures, rather merely from its quaint contrast with modern manners, than as a form into which the life of actually living men had shaped itself in former times. He himself edited a selection of his works (*Auserwählte Werke*, 12 Bde., Halle, 1841).—F.'s first wife, KAROLINE VON BRIEST, is also known in Germany as a productive authoress.

FOUQUET, or FOUCQUET, NICOLAS, 1615–80; Viscount of Melun and of Vaux, marquis of Belle-Isle, superintendent of finance under Louis XIV. Carefully educated with a view to official position, he was appointed master of requests at the age of 26. He was only 35 when he obtained the post of procureur-general to the parliament of Paris. During the civil war he devoted himself to the interests of the queen-mother, Anne of Austria, and enjoyed her protection. At her instance he was called, in 1652, to the office of superintendent of finance. The finances were then in a state of the utmost disorder from the long wars and the greed of courtiers and officials; and it is stated that he for a time provided the means of meeting the expenses of the state from his own fortune, or by loans obtained upon his own credit. He had long been in the confidence of cardinal Mazarin, the first minister, and was his zealous instrument. But shortly after the marriage of Louis XIV. a quarrel broke out between them, and from that time each was bent on injuring the other. The increasing deficit in the treasury alarmed the king; inquiries were addressed to Colbert, who, secretly ambitious of succeeding Fouquet as minister of finance, made the worst of the case against Fouquet. F. had bought the port of Belle-Isle, and strengthened its fortifications, with a view of taking refuge there in case of disgrace. He had spent large sums in building a palace on his estate of Vaux, which, in extent, magnificence, and splendor of decoration, was almost a forecast of Versailles. At this palace he entertained the king, in Aug., 1661, giving him a fête unrivaled for magnificence, at which *Les Facheux* of Molière was for the first time produced. But the king could not be appeased. By crafty devices, Fouquet had been induced to sell his office of procureur-general, thus losing the protection of its privileges, and he had paid the price into the treasury. The king, however, was only prevented from arresting him at the fête by the pleading of the queen-mother. The arrest was made about three weeks later at Nantes. Fouquet, after several removals from prison to prison, was at last sent to the Bastile. His trial extended over several years. In 1664. he was condemned and sentenced to perpetual exile, and to the confiscation of his property. The sentence, however, was commuted into one of imprisonment for life in the fortress of Pignerol. He bore his fate with fortitude, and composed in prison several devotional works. [Condensed from *Encyc. Brit.*, 9th ed.]

FOUQUIER-TINVILLE, ANTOINE QUENTIN, the notorious public accuser in the French revolution, was b. in the village of Hérouelles, in the department of Aisne, in 1747. His early career was immoral, but insignificant. On the outbreak of the revolution, he figured as one of the fiercest democrats. By Robespierre, he was appointed, first, a member, then director and public accuser, of the revolutionary tribunal. With-

out education, conscience, or sense of justice, he executed with brutal apathy the bloody orders of the committee of public safety. In reference to this feature of his character, his countrymen say that "he had no soul—not even that of a tiger, which at least pretends to be pleased with what it devours." Incapable of friendship, or of anything even remotely allied to generosity, he systematically abandoned his successive coadjutors in their hour of need, and sent to the scaffold, without the slightest compunction, Bailly and Vergniaud, Danton and Hebert, Robespierre and St. Just. He himself died by the guillotine, in a cowardly manner, 7th May, 1795.

FOURCHAMBOULT, a rapidly increasing t. of France, in the department of Nièvre, 5 m. n.n.w. from Nevers, near the right bank of the Loire, which is here crossed by a suspension bridge. It is a station on the railway between Orleans and Nevers. There are great iron-foundries, employing between 2,000 and 3,000 workmen. The manufacture of arms is extensively carried on. Pop. '76, 5,686.

FOURCROY, ANTOINE FRANÇOIS, Comte de, 1755–1809; b. Paris; a French chemist. At the age of 15, he became a student of medicine, lodging in a garret, supporting himself by giving lessons to other students, and making translations for a bookseller. In 1777, *Essai sur les Maladies des Artisans*, his first publication, appeared, being the translation of a Latin work by Ramazzini, with notes and additions. In 1784, his reputation as a chemist gained for him, although Berthollet was his fellow candidate, the lectureship of chemistry at the college of the jardin du roi, which had became vacant by the death of Macquer, one of the last of the phlogistic school. This post he held for 25 years; and so great were the crowds which his eloquence attracted that it was necessary to enlarge his lecture-theater twice. Fourcroy was one of the first converts to the theories of Lavoisier, which he designated "La Chimie Française." Together with Berthollet, Fourcroy was associated with Lavoisier and Guyton de Morveau, in 1786 and 1787, in the preparation of a work entitled *Methode de Nomenclature Chimique*, published in the latter year. In 1785, a memoir on the tendons gained for him admission into the French academy of sciences. He became, in 1792, one of the deputies of the national convention, and in 1793 a member of the assembly. He procured the release from imprisonment of Desault, surgeon of the Hôtel-Dieu, and prevented the execution of Darcet, though he found no opportunity of rescuing Lavoisier. On the 9th Thermidor he was appointed a member of the committee for the public safety, and in this capacity he instituted three schools of medicine, and assisted in the organization of other schools. After the revolution of Nov., 1799, he was made a councilor of state; and appointed director-general of instruction, in which capacity he secured the formation of numerous professional schools and colleges. On the 16th Dec., 1809, the very day on which by letters-patent he had been created a count of the French empire, with a yearly pension of 20,000 francs, he was signing some dispatches, when he suddenly exclaimed "Je suis mort," and with these words expired.

FOURCROY'A, a genus of plants of the natural order *amaryllideæ*, nearly allied to agave (q.v.), but with stamens shorter than the corolla. The species are all tropical. The leaves of some—perhaps of all—of them yield a fiber similar to the PITA FLAX obtained from those of species of *agave*.

FOUR EVANGELISTS, part of a larger group of islands known as the *Twelve Apostles*, lie off the w. entrance of the strait of Magellan. They are about lat. 52° 34′ s., and long, 75° 5′ west. The eight other islands, with which they are classed as above, run about 15 m. further out into the Pacific.

FOUR-EYES, a fish. See ANABLEPS, *ante*.

FOURIER, FRANÇOIS MARIE CHARLES, a French socialist, was b. at Besançon, April 7, 1772. His father, a merchant, had him educated in an academy at Besançon for his own profession. He distinguished himself by his perseverance and success in study, and excelled in geography, mathematics, music, and the natural sciences. He left his studies with regret to enter upon the duties of a merchant's clerk, which he performed with zeal and integrity at Lyons, Rouen, Marseilles, and Bordeaux. He also traveled in the interest of his employers, not only in France, but in Holland and Germany. In these journeys and residences, nothing escaped his observation; he noted climate, culture, population, public and private edifices, and remembered even the topography of villages, and the dimensions of buildings, with astonishing accuracy. His father died in 1781, leaving him about £5,000, which he became possessed of in 1793, and invested in trade at Lyons. This was lost in the revolution; and he was thrown into prison, and compelled to serve two years as a cavalry soldier. Discharged on account of illness, he obtained employment in a mercantile house at Marseilles, where he was employed to superintend the destruction of an immense quantity of rice, held for higher prices, in the midst of a scarcity of food, until it had become unfit for consumption. This circumstance called his attention to the frauds and duplicities of commerce, and he devoted his spare time to the study of social problems, until he developed the system of socialism to which his name is commonly given. This system is contained in several works, written and published under discouraging circumstances. In 1808, he published his *Théorie des Quatre Mouvements, et des Destinées Générales* (Theory of the Four Movements, and of the General Destinies of the Human Race). In 1822, he produced his *Traité*

d'Association Domestique Agricole (Treatise on Domestic and Agricultural Association); in 1829, *Le Nouveau Monde Industriel et Sociétaire* (The New Industrial and Social World); in 1831, *Pièges et Charlatanisme des Deux Sectes Saint-Simon et Owen, promettant l'Association et Progrès* (Snares and Quackeries of the Two Sects of St. Simonians and Owenites, promising Association and Progress); in 1835, *La Fausse Industrie, Morcelée, Repugnante, Mensongère, et l'Antidote, l'Industrie Naturelle, Combinée, Attrayante, Véridique, donnant Quadruple Produit* (False Industry, Fragmentary, Repulsive, and Lying, and the Antidote, a Natural, Combined, Attractive, and Truthful Industry, giving Quadruple Products). These works, written in the midst of commercial pursuits, and published at long intervals, by means of his small savings, found for many years few readers, and no disciples. Towards the close of his life, a small group of intellectual men accepted his views, and gathered round him, to learn the details of his social system from his own lips. He was unwearied in his efforts to interest men of power or capital, who could give his theories the test of practical realization, and for many of the last years of his life waited patiently at a certain hour every day, expecting to be visited by such a patron. His less patient disciples probably hastened his death by immature and partial efforts at realization. He died in Paris, Oct. 8, 1837.

FOURIER, JEAN BAPTISTE JOSEPH, Baron, a distinguished French mathematician, was b. of a respectable family at Auxerre, 21st Mar., 1768. He became a pupil, and at the age of 18, a professor, in the military school of his native place. He was afterwards removed to the normal school in Paris, and then to the Polytechnic, and accompanied gen. Bonaparte to Egypt. Besides performing political services on this occasion, he was secretary to the *Institut d'Egypte*, and an active contributor to the *Description de l'Egypte*, the masterly historical introduction to which is from his pen. On returning to France, he was made préfet of the department of Isère in 1802, an office which he held till 1815, and was created baron in 1808. As préfet, he succeeded in draining the marshes in Bourgoin, near Lyons, which had for centuries baffled all attempts. On the return of Napoleon from Elba, F. issued a royalist proclamation; notwithstanding which he was appointed by Napoleon préfet of the department of the Rhone, but was shortly after removed. He now took up his abode in Paris, and devoted himself exclusively to science. The academy of sciences, which in 1807 had crowned his essay on the propagation of heat through solid bodies, chose him a member in 1815, and afterwards secretary for life, conjointly with Cuvier. He died 16th May, 1830.

His most famous work is the *Théorie Analytique de la Chaleur* (Par. 1822), in which he applies new methods of mathematical investigation. An allied subject is discussed in his *Mémoire sur les Temperatures du Globe Terrestre et des Espaces Planétaires* (Par. 1827). Besides heat, he occupied himself with the theory of equations, which received from him important improvements. His work, *Analyse des Equations Déterminées*, distinguished both for its substance and manner of exposition, was left unfinished, and was published after his death by Navier (Par. 1831).

FOURIER, PIERRE, 1565–1640; b. France; became canon in the abbey of Chamonsay; afterwards pastor of the parish of Mataincourt. He established several free schools, and laid the foundations of the congregation of Notre Dame, for the education of girls, a society which speedily overspread France and the French American colonies. He was mainly instrumental in founding the new congregation of St. Savior, the purpose of which was the education of Christian youth. Nine houses were very soon established, and he was chosen superior general. He was beatified 90 years after his death, and is generally known as "Blessed Peter Fourier." The chief house of the sisterhood of Notre Dame in America is in Montreal.

FOURIERISM, the social system invented by Charles Fourier, is contained in his published works, in a large connection of unpublished MSS., and in the writings of Considerant, Lechevallier, Brisbane, and others of his disciples. It differs materially from the systems of communism strictly so called, and all other social theories, and professes to be based upon natural laws, and capable of being carried out on mathematical principles, as fixed and certain as those of geometry, music, or colors. The earth and human society, Fourier taught, are in their crude and infantile stage. The period of the race will be 80,000 years, the latter portion of which will be its declining phase, as the present is its ascending. The middle term will be a long period of maturity, prosperity, and happiness. What we call civilization, Fourier considers a false and imperfect condition, with poverty, crime, ignorance, idleness, repugnant toil, disease, wasting wars, general antagonism, oppression, and misery. He believed that association would produce general riches, honesty, attractive and varied industry, health, peace, and universal happiness. Considering attractions and repulsions the governing forces of all nature, and that God has distributed them for the happiness of all his creatures, he held that "attractions are proportional to destinies," or that the desires or passions of men, their aptitudes and inclinations, if they could have free scope, would infallibly produce the highest condition and greatest happiness of which they are capable. He believed in a universal harmony, flowing from and centering in God, the author of all harmonies, and that there is therefore a principle of "universal analogy." Seeing that all things, from suns and planets to atoms, range themselves in groups and series, according to certain fixed laws of attraction and repulsion, he labored to discover the kind of human society

that must eventually form itself in obedience to those laws. This is the association or phalanstery, which is to consist of 400 families or 1800 persons, which number he found included the whole circle of human capacities. These should live in one immense edifice, in the center of a large and highly cultivated domain, and furnished with workshops, studios, and all the appliances of industry and art, as well as all the sources of amusement and pleasure. When the earth is covered with palaces of attractive industry, the associations will also unite in groups and series, under a unitary government. There will be but one language and one government, and the only armies will be the great industrial armies, which will drain swamps, irrigate deserts, plant forests, and effect the amelioration of climates. The system of Fourier does not propose to destroy, but rather to conserve property, position, and hereditary rights, nor does it war directly with morals or religion. The property of the association is to be held in shares, and the whole product of the industrial and artistic groups is to be divided into 12 parts, of which 5 parts are due to labor, 4 to capital, and 3 to talent. The apartments are to be of various prices, and the styles of living to vary in luxury and cost; but the poorest person in the association is not only to be secure of comfort, but his minimum of enjoyments will be greater than the present social arrangements can give to princes and millionaires; while these will have opened to them pleasures of which they can now scarcely have a conception. The economics of the large scale in the phalanstery reduce by two thirds the expenses of living, while an attractive and scientific industry would quadruple the products of civilization.

The passions of the human soul to which the system of Fourier would give full scope, he described as the five sensitive—sight, hearing, taste, smell, touch; four affective—friendship, love, ambition, and paternity; three distributive—the emulative, alternating, and composite. In these he found the springs of industry and true society. Emulation, the desire of success, honors, rewards, is the great stimulant to exertion; alternation of employments makes work a recreation; and the composite passion requires combinations of charm and enjoyment which only association can give. Many attempts have been made—a few in France, and more in America—to carry the ideas of Fourier into practical realization; but they have all been on a small scale, and with inadequate means, and have resulted in failure. Whatever we may think of the system, in its principles or its theoretical development, nothing can be founded upon the failure of such experiments. It remains to be proved whether human nature, in its present state, is capable of carrying out successfully a social system so widely varying from all existing social conditions. The moral objections to F. are, that it appears to make luxury, ambition, and sensual delights the end of existence—the incentives and rewards to all exertions; and that the passions of men, when left in the perfect freedom which this system requires, would lead to ruinous demoralizations. The answer is, that "attractions are proportional to destinies," and that these excesses belong to the present state, and are incident to the poverty and repressions of civilization, but could not exist in a true society; which raises the question—What is a true society? Whatever may be thought of the practicability of the system, its study in the works of Fourier is full of suggestions to the student in sociology.

FOUR LAKES, a chain of connected sheets of water in Wisconsin, U. S., are fed chiefly by springs, and form, through their outlet, the Catfish, a north-eastern source of the Mississippi. They are navigable for steam-boats, and drain a beautiful country. Madison, the capital of the state, stands on the strip of land which separates the uppermost of the series from the next in order.

FOURNET, VICTOR, 1801–69; b. Paris; educated at the school of mines. He rendered valuable service in geology, mineralogy, etc., and was a careful observer of physical phenomena. He was the originator of many improvements in the treatment of lead ores, and the discoverer of "Fournet's law" in reference to sulphurization of metals.

FOURNI ISLANDS (anc. *Corássia* or *Córseae*), a group of about 20 small islands in the Grecian archipelago, between Nicaria and Samos, on the eastern coast of Asiatic Turkey. The largest of these islets is about 5 m. in circuit.

FOWEY, or FOY, a borough t. on the s. coast of Cornwall, on the right bank of the river Fowey, 25 m. s.s.w. of Launceston. It is sheltered by hills, and lies amid picturesque scenery, rude sea-cliffs, and promontories. The harbor admits large vessels at all states of the tide, and its entrance is guarded by three forts. The chief business is catching and curing pilchards, which, with "china-stone" and iron-ore, form the main exports. F. sent 47 ships and 770 men to the siege of Calais by Edward III. in 1347. It was burned by the French in 1457, and taken by Fairfax in 1646. Pop. '71, 1394.

FOWL (Ger. *vogel;* allied to the Lat. root *fug-*, to flee, and perhaps to *wag-*), a word originally synonymous with *bird*, and still employed in that signification, but also in a much more restricted sense, as the designation of the genus of birds (*gallus*) to which the common domestic F. (*G. domesticus*) belongs. This genus gives its name to the important order of *gallinaceous birds*, also called, from their well-known habit of scraping the earth in search of food, *rasores* (Lat. scrapers); and is included in the family *phasianidæ*, with pheasants, tragopans, etc. The general form, and the characters of the bill, feet, etc., agree with those of the pheasants; but the crown of the head is gen-

erally naked, and furnished with a fleshy *comb*, the base of the lower mandibles also bearing fleshy lobes or *wattles*, characters which are most conspicuous in the males; and the tail is very different from that of the pheasants, and, indeed, very singularly formed, being composed of fourteen feathers in two nearly vertical planes, or as if a horizontal tail were folded together, so as to make a sharp angle at top, the two middle feathers being the uppermost, and in the males elongated beyond the rest, and gracefully arched. The tail-coverts of the male are also very ample, and the feathers of the back of the head and of the neck are either elongated and loosely webbed, forming the *hackles*, so much valued by anglers for dressing artificial flies, or are otherwise modified to serve the purpose of adornment; characters which are also sometimes exhibited in a very inferior degree in the female sex. The legs of the male are armed with spurs, as in the pheasants, of which much use is made in the combats of these birds among themselves, all of them being very pugnacious. They are all polygamous, and unable to endure the presence of a rival. They are all natives of the East Indies and of the Malayan archipelago. From what country, and at what period, the domestic F. was originally introduced into Europe, is uncertain. The remains of Egyptian antiquity carry us back to a period when it was apparently unknown in Egypt, and there is no distinct allusion to it in the Old Testament; but it seems to have been common in the s. of Europe from the earliest ages of European civilization. The cock was sacred to Apollo, to Mercury, to Mars, and to Æsculapius. It was figured on Grecian and Roman coins and gems; it was highly valued for its courage and pugnacity, and the sport of cock-fighting was a favorite one both with the Greeks and the Romans, as it is amongst the Chinese, the Malays, and many other nations at the present day, and in former times was amongst all classes of society even in Britain. See COCK-FIGHTING. The domestic F. appears to have been known to the ancient Britons before the Roman invasion; and when the South sea islands were first visited by Europeans, it was found there in the same domesticated state, and there also cock-fighting was found to be a fashionable amusement of the savage natives. The native country of the domestic F. is not certainly known, nor is it certain what the species is in its original state. The ancient Greeks sometimes called it the *Persian bird*, and hence it has been supposed to be a native of Persia; but there is nothing else to support this opinion, and it seems likely enough that this appellation may at most only indicate its introduction into Greece from Persia. The jungle F. of India, the first species of *gallus* known in its wild state to naturalists, was for some time supposed to be the origin of the domestic F., but to this opinion there are strong objections in the very peculiar character of some of the feathers which distinguish the jungle F., and of which no trace ever appears in the domestic F. More recently, the bankiva F. and other species have been discovered in Java and other islands of the eastern archipelago, more nearly resembling the domestic F., and the distribution of the latter through the islands of the Pacific ocean is favorable to the belief that it derived its origin from that region; but still the identification of the species remains difficult, and some naturalists incline to the opinion that the domestic F. may be derived from intermixture of distinct wild races.

The BANKIVA F. (*G. bankiva*), native of Java, is extremely similar to some of the domestic varieties; indeed, sir William Jardine says: "Many bantams so nearly resemble this bird, that there would be great difficulty in making a distinction. The comb is large and lobed, or dentelated; the colors are brilliant, steel-blue and chestnut, black and yellowish brown, the hackles abundant and golden orange; some parts of the plumage exhibiting a very fine play of colors. A very similar species, or a variety of the same, but rather larger, is found in some parts of continental India." Very similar also is the BRONZED F. (*G. æneus*), found in Sumatra, a bird resplendent in metallic green, purple, and lake; but of which the comb has the upper margin unbroken; the wattles are combined into one attached to the center of the throat; and the neck feathers do not assume the *hackle* character, which appears in the neighborhood of the tail alone. These peculiarities also belong to the FORK-TAILED F. (*G. furcatus* or *Javanicus*), a species very abundant in the jungles of Java, and often to be seen on their outskirts, nearly 2 ft. in length from the tip of the bill to the extremity of the tail. A still larger species—if, indeed, these are not rather varieties than species—is the GIGANTIC F., JAGO F., or KULM F. (*G. giganteus*) of Sumatra, with double wattle under the throat, abundant hackles on the head, neck, and upper part of the back, green and reddish yellow the principal colors, and the height considerably more than 2 feet.—The JUNGLE F. (*G. sonneratii*), abundant in the higher wooded districts of India, where it is much sought after by European sportsmen, is about equal in size to an ordinary domestic F., but is more slender and graceful in its form; the comb of the male is large, and its margin broken: the colors are rich and beautiful; but a remarkable peculiarity is exhibited in the hackle feathers, which are terminated by flat horny plates of a golden orange color, into which the shaft expands, or the shaft thickening and terminating abruptly gives rise to a battledore-like stem and disk, in substance like the tips of some of the feathers of the wax-wing.

Of the domestic F., there are some very curious varieties, of which some naturalists have attempted to constitute distinct species, particularly the NEGRO F. (*G. morio*), rarely seen in British poultry-yards, remarkable for the black color of the *periosteum* (the outer covering of the bones), and the dull purple of the comb, wattles, and skin;

the SILKY F. (*G. lanatus*), very common in China and Japan, with periosteum and skin of the same dark color as the negro F., but the flesh remarkably white, the comb and wattles purple, the feathers with webs disunited and silky; and the FRIESLAND (probably a mistake for FRIZZLED) F. (*G. crispus*), which has all the feathers standing nearly at right angles to the body.

There are also varieties of the domestic F. remarkable for what may be considered monstrosities—as the want of a tail and of some of the last vertebræ, the presence of an additional spur on each leg (Dorkings, etc.), superabundant combs, crests or tufts of hackle feathers instead of combs, tufts of feathers springing from the lower jaw (the SIBERIAN F.), etc.; and there are many varieties esteemed by keepers of poultry, of which the most important are—1. The GAME F., with erect and slender body and showy colors, valued also for the delicacy of the flesh and of the eggs, although the eggs are rather small. It is this breed which is used for cock-fighting; and so excessive is the pugnacity which characterizes it, that broods scarcely feathered are occasionally found to have reduced themselves to utter blindness by their combats. Some poultry-keepers think it good to have a game-cock in their poultry-yard, on account of the improvement of the quality of the fowls sent to the table; but it is almost needless to say, he must, like the prototype of Robinson Crusoe, be sole monarch of all he surveys. 2. The DORKING F., so named from Dorking, in Surrey, where it has long been bred in great numbers for the London market—a breed characterized by an additional spur on each leg; often of a white color, with short legs; one of the most useful of all breeds, both for excellence of flesh and for abundance of eggs. 3. The POLISH F., black, with a white tuft, a breed very extensively reared in France, Egypt, etc., little inclined to incubation, but valued for an almost uninterrupted laying of eggs. 4. The SPANISH F., very similar to the Polish, but larger, and laying larger eggs, on account of which it is now much valued, and very common in Britain; black, with white cheeks and large red comb. 5. The MALAY F., tall and handsome, very pugnacious, but little esteemed. 6. The HAMBURG, of very beautiful plumage, and much valued for the quality both of flesh and eggs, as also for extreme productiveness of eggs. 7. The COCHIN CHINA F., a large, tall, ungraceful variety, with small tail and wings, for which there was a great rage among poultry-fanciers when it was newly introduced into Britain, particularly about the year 1852, and which is valuable chiefly on account of its fecundity, eggs being laid even during winter, and the hens incubating frequently. 8. The BANTAM F. (q.v.), a diminutive variety, rather curious than useful. —Of most of these there are many subvarieties and *fancy breeds*—gold-penciled, silver-penciled, etc. The common DUNGHILL F. is apparently a breed produced by the intermixture of others, and perhaps chiefly a less graceful, less spirited, and less pugnacious race of the game fowl.

Concerning the treatment of the domestic F. in the poultry-yard, the diseases to which it is liable, etc., see POULTRY. The artificial hatching of eggs is noticed in the article INCUBATION. Concerning the eggs of the domestic F. as an article of commerce, etc., see EGG.

The readiness with which the domestic F. can be induced to go on laying eggs far beyond the number proper for a brood, is not nearly equaled in the case of any other domesticated bird, and greatly enhances the usefulness of this species to mankind, whether the eggs are used for food, or, by artificial hatching, made to produce chickens, as is common in Egypt and some other countries. Few hens incubate oftener than once a year, but some lay in the course of a year even more than 200 eggs.

FOWLE, DANIEL, 1715–87; b. Mass.; a printer in Boston in 1740; with Gamaliel Rogers, he printed the first American edition of the New Testament. He was arrested for publishing seditious matter in the *Independent Advertiser* and in pamphlets, and kept for a short time in prison. Upon his release he went to Portsmouth, and in 1756 started the *New Hampshire Gazette*, a weekly newspaper still published.

FOWLER, CHARLES U., D.D.; b. Canada, 1837; graduated at Genesee college in 1859, and in 1861 became a Methodist minister. He was pastor of a church in Chicago until 1872, when he was chosen president of the Northwestern university (M. E.) at Evanston, Ill.

FOWLER, JOHN, b. England, 1817; a hydraulic and railway engineer. After engaging in various important works, he became acting-engineer in the construction of the Stockholm and Hartlepool railways. At the age of 27 he was selected as engineer for the construction of the large group of railways known as the Manchester, Sheffield, and Lincolnshire. Having settled in London, he was continuously employed in the laying out and construction of railways and docks, and in the improvement of rivers, and reclamation of lands from the sea. Probably he is best known as "Fowler of the Underground railway," having designed and constructed the metropolitan "Inner Circle railway." Mr. Fowler is consulting engineer to several railways, and to the government of Egypt.

FOWLER, LORENZO NILES, b. Ohio, 1811; brother of Orson, and also a phrenologist and lecturer. He went to England in 1863, and still remains there. Besides works in which he was an assistant, he has published *Synopsis of Phrenology and Physiology*, and *Marriage, its History and Philosophy, with Directions for Happy Marriages.* He was

also concerned in editing the *Phrenological Journal*, and the *Water Cure Journal*, afterwards called *Science of Health*.

FOWLER, Lydia Folger, 1823–79; b. Mass.; wife of Lorenzo. She was a graduate of a medical college in New York, and was one of the first American women to practice medicine. She lectured on physiology and the diseases of women and children, and wrote *Familiar Lessons on Phrenology and Physiology*, and similar lessons on astronomy.

FOWLER, Orson Squire, b. New York, 1809; graduated at Amherst. He and his brother Lorenzo were among the first Americans to accept and teach the doctrines of phrenology, beginning in New York city in 1835. The next year Orson published *Phrenology Proved, Illustrated, and Applied*. This was followed by an almost continuous series of works on the same and on kindred subjects, by the establishment of the firm of Fowler & Wells, the starting of the *Phrenological Journal* (still published), and an almost incredible amount of work in the form of lectures, addresses, and teaching. Some of the works in whole or in part by Orson are *The Self-Instructor in Phrenology and Physiology; Memory and Intellectual Improvement Applied to Self-Education; Matrimony, or Phrenology Applied to the Selection of Companions, Self-Culture, and Perfection of Character; Hereditary Descent, its Laws and Facts Applied to Human Improvement; Love and Parentage Applied to the Improvement of Offspring.*

FOWLER'S SOLUTION. See Arsenic.

FOWLING—the killing or taking of birds for the sake of their flesh, feathers, etc.—is very variously practiced in different parts of the world. In some places it is one of the principal employments of the people, who greatly depend on it for their subsistence, and prosecute it with the greatest toil and danger; elsewhere, it is in some of its forms a recreation, for the sake of which much expense is incurred by the opulent. The modes in which it is practiced depend partly on the habits of different kinds of birds, and partly on the progress of civilization and the arts. The peculiar habits of some birds render it very easy to take or kill them. Nets are much used in the capture of many kinds of birds, particularly of small birds intended for the table; bird-lime is employed for the same purpose, and birds are taken by means of it in greatest numbers near their drinking-places, particularly in hot and dry weather; gins, springes, and traps of various kinds are also employed.

The numerous kinds of ducks, geese, and other *anatidæ*, are, in an economical point of view, among the most important of birds, and the methods employed for their capture are very various and interesting. These, however, we reserve for a separate article, Wildfowl; and refraining also here from any notice of the amusements of the sportsman, we shall proceed to describe the methods adopted in *rock-fowling*, on which the inhabitants of many northern coasts and islands, in a great measure, depend for their means of subsistence. Of all kinds of F., it is by far the most adventurous. The objects of pursuit are gannets or solan geese, gulls, terns, guillemots, and other seabirds, which frequent the most lofty precipices, and breed on their shelves and ledges. The flesh, even of the best of them, is generally coarse, and of a fishy taste, yet it forms great part of the food of the poor people, both fresh and salted for winter provisions. The flesh of the young is more tender and pleasant than that of the adult birds. The eggs of some species are sought after by the same perilous means as the birds themselves. The feathers and oil are articles of commerce. The people of St. Kilda pay part of their rent in feathers and fulmar oil, the rocks being apportioned among its inhabitants as exactly as its soil. Almost every man in the island is a cragsman or rock-fowler, which is pretty nearly the case also in many other northern isles. The multitudes of sea-fowl around many of the rocky northern coasts is prodigious, resembling at a distance—as may be seen at the bass rock in the firth of Forth—the bees around a busy hive. Uninhabited islets are annually visited by fowlers, as Borrera by the people of St. Kilda; and the "stacks," or high insular rocks near the shore, are often extremely productive. These are, of course, reached by means of a boat, and whilst landing is often both difficult and dangerous, the climbing of the precipice is still more so. The Norwegian fowlers, or "bird-men," carry on such expeditions with a *bird-pole* or *fowling-staff*, about five or six yards long, and a rope of several fathoms. The bird-pole has an iron hook at one end; it has also a flat head, and by means of it the fowler is pushed and guided by his comrades below as he ascends a very steep or precipitous cliff; by means of it, also, he strikes down or draws in birds. The rope is used to fasten two fowlers together, being attached to the waist of each; they aid one another in climbing, pushing, and drawing one another up the rocks, the safety of the one often depending on the strength and courage of the other. The bird-pole is also used with a small net attached to it, in the capture of birds that are flying around. The Norwegian fowlers sometimes remain for days on ledges where birds are abundant, sleeping in holes or clefts, and having food let down to them by a rope from above.

Still more perilous, if possible, is the mode of F. practiced where the precipices cannot be scaled. The fowler is let down by a rope, and hangs in mid-air, often at an elevation of several hundred feet, above rough rocks or roaring waves, and by means of his feet or of a pole, throws himself out to such a distance from the face of the rock as to obtain a view of all its ledges and crannies, to which, with astonishing coolness

and dexterity, he directs his course, often also catching the birds that fly near him in the air. Speaking of the fowlers of St. Kilda, Wilson (*Voyage Round the Coasts of Scotland and the Isles*) remarks: "How one man (for such is the case), himself standing with the points of his toes upon the verge of a precipice many hundred feet deep, can, with such secure and unerring strength, sustain the entire weight of another man, bounding from point to point below him with irregular and frequent springs, is what a stranger cannot understand....But we ascertained that there is never more than a single man above, supporting the weight of the one below. Each of these couples has two ropes. The rope which the upper man holds in his hands is fastened round the body and beneath the arms of him who descends, while another rope is pressed by the feet of the upper man, and is held in the hand of the lower." The second rope is for giving signals, and for sending up birds when captured. The principal rope used to be made of twisted raw cow-hide; it was so durable as to last for two generations, and was bequeathed as valuable property by father to son. Manilla hemp is now chiefly used instead. The practice differs also as to the number of comrades holding the rope above. In the Faroe isles, where some of the precipices are 1400 feet in height, the rope is usually held by a number of men. In some of the Scottish islands, fowlers have been adventurous enough to descend the cliffs unaided, fastening the rope for themselves to a stake driven into the ground above. The fowlers of the Faroe isles sometimes use the pole with net at the end, whilst suspended in the air. It is not unusual for the fowler, when he finds a ledge, or recess in the precipice abounding in birds, to disengage himself from the rope whilst he pursues his labors there; but when the precipice overhangs above, he is exposed to a great danger of the rope's escaping from his reach. A case is on record in which the only resource of the fowler was to make a desperate spring and catch the rope, which hung a few feet before him in the air, and this he succeeded in doing.

Rock-fowling is carried on at the Holm of Noss, a precipitous insular rock, separated from Noss, one of the Shetland isles, by a chasm of 65 ft. wide, and 160 ft. deep, over which ropes have been stretched, so that a *cradle*, or sparred box, can be made to pass along them, affording access to the grassy summit of the Holm, where a few sheep are occasionally fed, and where innumerable sea-birds make their nests.

FOWLING-PIECE, a light gun for shooting birds. In constructing the barrels of this sporting weapon, the maker endeavors to secure the greatest possible lightness without detracting from the necessary strength. Formerly, wrought-iron only was used, but cast-steel is now generally preferred. The breech-loading principle has been introduced to a great extent, but many sportsmen are still in favor of the muzzle-loader. The manufacture of the best specimens of fowling-pieces demands a high degree of mechanical skill.

FOWLS OF WARREN. Lord Coke says they are "the partridge, quail, rail, etc.," "pheasant, wood-cock, etc.," and the "mallard, heron, etc.," leaving the etcæteras without explanation (*Co. Litt.* 233). Manwood, again, lays it down that there are only two F. of W., the pheasant and the partridge (Manw. 95). In the duke of Devonshire *v.* Lodge (7 B. and C. 36), it was decided that grouse are not birds of warren.

FOWNES, GEORGE, 1815-49; b. England. His inclination was towards chemistry, and in 1837 he began to lecture on that science. Two years later he studied under the celebrated Leibig at Giessen, and afterwards filled a number of professorships in his own country. In addition to his well-known *Manual of Chemistry* he published nearly a dozen works on chemical and cognate subjects.

FOX, *Vulpes*, a genus of *canidæ* (q.v.), particularly distinguished from dogs, wolves, jackals, etc., by the pupils of the eyes contracting vertically, and in the form of the section of a lens, not circularly. This takes place whenever the eyes are turned to a strong light, and foxes are all nocturnal animals. Foxes are also generally of lower stature in proportion to their length than the other *canidæ;* they have a roundish head, with a very pointed muzzle, short triangular ears, slender limbs, and a bushy tail. They dig burrows for themselves in the earth, or take possession of holes already existing. They are famous for their cunning, which they exhibit both in their artifices for obtaining prey, and for escaping from danger. They feed on small quadrupeds, birds, eggs, etc.; some of them, however, also partly on fruits and other vegetable substances.—The COMMON FOX (*V. vulgaris*), a native of most parts of Europe, is the only British species, and is still pretty abundant in most parts of the country, although from many parts it would probably have been extirpated ere now, unless it had been in some measure protected with a view to the sport of fox-hunting. The common F. is reddish brown above, white beneath; the outside of the ears black, a black line extending from the inner angle of the eye to the mouth; the legs mostly black, the end of the tail generally white, although specimens sometimes occur in which it is gray, or even black. There are at least three varieties known in Britain, pretty well marked by difference of size and form—the *greyhound fox* being more slender and longer-limbed, and the *cur fox*—frequent in upland moorish districts—being smaller than the common variety. Other varieties occur in the n. of Europe. The F. has a gland under the tail, which secretes a very fetid substance, communicating to the whole animal its well-known smell. It breeds once in a year, having usually four, five, or six young ones in a litter.

Its usual voice is a kind of yelp. Its senses of sight, hearing, and smelling are very acute. Innumerable anecdotes are on record illustrative of its cunning. The difficulty of setting traps so that they shall not be detected and avoided by it, is well known. Foxes are said to have been observed approaching water-fowl by swimming slowly with a turf in the mouth, so as to remain concealed. A most trustworthy person assured the writer of this article, that he saw a F. approach a group of hares that were feeding in a field, with a slow, limping motion, and having his head down as if eating clover, till he was near enough, by a sudden rush, to secure very different food. Foxes captured in hen-roosts have often been known to simulate death, and to submit to being dragged about and very roughly treated without a sign of life, till an opportunity of escape presented itself. When they are driven to their holes, and these are surrounded with traps, they not unfrequently show such a just appreciation of the danger, that they will endure starvation for days and even weeks rather than come out. Even when taken young, the common F. can hardly be tamed; and very few instances are on record of its showing even a little of that attachment to man of which so many animals are capable, and for which the dog is so remarkable. The improbability of any of the domestic races of dog being at all derived from the F., is noticed in the article Dog. The French *renard* ap ears in English in *reynard*, the familiar appellation of the fox.—The s. of Europe produces foxes of smaller size than the common F., having the fur of the belly black, regarded by some as a mere variety, by others as a distinct species (*V. melanogaster*). They are less carnivorous, and to them some of the allusions and fables relate—as of the fox and grapes, etc.—which do not accord well with the habits of the foxes of Britain and of northern Europe.—The Himalaya mountains produce a species of F. (*V. Himalaicus*) very similar to the common F., but of superior size and brilliancy of colors. The fur is rich and fine.—The Black Fox of northern Asia is also very similar to the common F. but is entirely of a velvety black color, except the tip of the tail, which is white; its fur is greatly esteemed, brings a high price, and forms an article of export from Kamtchatka to China.—The Coal Fox (*V. alopex*) of some parts of Europe, as Switzerland and Bavaria, is by some naturalists regarded as distinct from the common fox. It is of inferior size, more timid, and less troublesome; the tip of the tail is black. —North America has several species of F., of which the Red Fox (*V. fulvus*) very nearly resembles the common F. of Europe, but is of rather larger size, has a shorter muzzle, eyes nearer each other, and a more copiously bushy tail. Its fur is also longer, finer, more brilliantly colored, and much more valuable, forming a considerable article of export from the fur countries; in which, as well as in Canada, and in the northern parts of the United States, this species is abundant. The Cross Fox is a variety of it, distinguished by a longitudinal dark band along the back, crossed by a transverse band over the shoulders. The burrow of this F. "at first inclines downwards for 4 or 5 ft. at an angle of about 25 degrees, it then inclines upwards a little, which is a security against inundations, and is continued at a depth of about 3 or 4 ft. from the surface, until it reaches a point where it is divided into two or three galleries." Great numbers of these foxes are annually tracked to their burrows, and digged or smoked out of them by American farmers.—The Gray Fox (*V. Virginianus*) is the most abundant species of the southern states, extending, however, as far n. as Canada, where it is rare. It is of a gray color, varied with black, is about the size of the common F., but not so bold, and sometimes eats vegetable substances, such as ears of maize. The gray F. exhibits not a little of that cunning for which the common F. is celebrated, and when pursued by hunters and hounds, has been known to escape by getting upon the rail of a fence and running along it for some distance, so that the scent was lost. This was on one occasion done on the newly-laid rail of a railroad elevated above a swamp. It is not unfrequent for the gray F., when hard pressed, to take refuge in a tree, particularly if one which has somewhat fallen from the perpendicular presents itself.—There are a number of other species of F., Asiatic, African, and American; but the most deserving of notice is the Arctic Fox (*V. lagopus*), which inhabits the most northern parts of Europe, Asia, and America. It is very plentiful in Iceland, feeding much on ptarmigans, and sometimes on young lambs. Great numbers are found on the shores of Hudson's bay, particularly during winter, and they have been supposed to migrate thither from still more northern regions; but it has been ascertained that this animal spends the winter even in the most northern regions that have ever been visited by man, braving the cold of Melville island and Banks's island, and finding abundance of food in the hares, marmots, ptarmigans, and other animals which also remain there. The Arctic F. is rather smaller than the common F.; it is more densely clothed with a woolly fur, which on some parts is 2 in. in length; the tail is extremely bushy; and even the soles of the feet are thickly covered with hair. The color is pure white in winter, at least in very cold climates, varying to a brownish or bluish color in summer. It is gregarious, and many burrows are often found together. It is extremely cleanly in its habits, and is quite devoid of the offensive smell which belongs to most of the foxes; it is also much less cunning, and much more easily trapped, as well as much more gentle and capable of being tamed. Its flesh has been sometimes eaten by arctic voyagers, with a relish due to the extreme cold of the climate, and the consequent demand of the system for animal food. Its fur is not nearly equal in value to that of the red fox.

FOX, CHARLES JAMES, a celebrated whig statesman, was the second son of Henry Fox, first lord Holland, by lady Georgiana Carolina, eldest daughter of the duke of Richmond. He was born, according to lord John Russell's memoir, on the 24th Jan., 1749 (N.S.), and was educated at Eton and Oxford, spending his vacations on the continent in the gayest and wittiest circles of the French capital, and visiting Switzerland and Italy. Notwithstanding the irregular life which he led even as a school-boy, he was very distinguished for ability both at school and college; and so high was his father's opinion of his talents, that at the age of nineteen he had him brought into parliament as member for the borough of Midhurst, a step to which he is said to have been further incited by the fact, that, even at this early age, F.'s energies had found an outlet in gambling and various other forms of dissipation. His precocity in vice, as well as in intellectual development, is said to have been the result of the injudicious fondness of his very unprincipled but very gifted father. Till he attained his majority, F. prudently kept silent in the house, but immediately thereafter he appeared as a supporter of the administration of lord North, and was rewarded with the office of one of the lords of the admiralty. In 1772, he resigned that office, and the following year was named a commissioner of the treasury. From that post he was dismissed, in consequence of a quarrel with lord North. and passed over to the ranks of the opposition. During the whole course of the American war, he was the most formidable opponent of the coercive measures which were adopted by the government, and the most powerful advocate of the claims of the colonists; acting, to this extent at least, in accordance with the views which for many years before had been urged upon the country by the great lord Chatham, the father of his future rival Mr. Pitt. The difference between them was, that whereas lord Chatham urged conciliation, in order to preserve the connection between the two countries, F. foresaw and foretold the necessity and the advantages of complete separation. In 1782, on the downfall of lord North, F. was appointed one of the secretaries of state, which office he held till the death of the marquis of Rockingham, when he was succeeded by the earl of Shelburne, afterwards marquis of Lansdowne. On the dissolution of the Shelburne administration, the North and F. coalition was formed, and F. resumed his former office; but the rejection of his India bill by the house of lords soon after led to the resignation of his government. It was now that Mr. Pitt came into power, and that the long and famous contest between him and F., who occupied the position of leader of the opposition, commenced. In 1788, he enjoyed a short respite from his public labors. Accompanied by his wife, he visited the continent, and having spent a few days at Lausanne, in the company of Gibbon, who was there engaged in writing his famous history, he set out for Italy. The sudden illness of the king, however, and the necessity of constituting a regency, rendered it undesirable that he should be longer absent from England, and he hastened back to his post. The regency, the trial of Warren Hastings, the French revolution, and the events which followed it, gave ample scope to the talents and energies of F., and on all occasions he employed his influence to modify, if not to counteract, the policy of his great rival. He was a strenuous opponent of the war with France, and an advocate of those non-intervention views which find greater favor in our day than they did in his. After the death of Pitt, F. was recalled to office, and endeavored to realize his doctrines by setting on foot negotiations for a peace with France, the results of which he did not live to witness. He died on the 13th Sept., 1806, in his 59th year. In private life, Mr. F. was a genial companion, kindly and sincere in the closer relations of friendship, whilst his conduct to those to whom he was opposed in public was generous, and free from every trace of malignity or enmity. Lord John Russell, in the preface to his *Memorials and Correspondence*, speaks of the singular candor, boldness, simplicity, and kindness of his character; and of his oratorical powers it is enough to record, that Burke called him "the greatest debater the world ever saw," and sir James Mackintosh, "the most Demosthenian speaker since Demosthenes." His remains were interred in Westminster abbey, so near to those of Pitt, as to suggest to sir Walter Scott the well-known couplet—

> Shed upon Fox's grave the tear,
> 'Twill trickle to his rival's bier.

FOX, GEORGE, the originator of the society of friends (q.v.), commonly called Quakers, was b. at Drayton, in Leicestershire, in 1624, and at an early age was employed in keeping sheep. Subsequently, he was apprenticed to a country shoemaker; but when about 19 years of age, his religious impressions produced such a strong conviction in him, that he believed himself to be the subject of a special Divine call; and abandoning his usual avocations, wandered solitarily through the country, dressed merely in a leathern doublet of his own making, and absorbed in spiritual reveries. After some time, his friends induced him to return home, but F. stayed with them only for a short period, and finally adopted the career of an itinerant religious reformer. About 1646, he left off attending church for divine worship, but did not scruple to interrupt the services when conducted by "professors," i.e. formalists, or persons whom he believed not to be genuine Christians. His first efforts at proselytism were made at Manchester in 1648. The excitement caused was very great, and, in consequence, F. was imprisoned for some time as a disturber of the peace. It may be proper to men-

tion here, that his leading doctrines or convictions were the futility of learning for the work of the ministry, the presence of Christ in the heart as the "inner light," superseding all other lights, and the necessity of trying men's opinions and religions by the Holy Spirit, and not by the Scriptures. F. next traveled through various of the midland counties, Derby, Leicester, and Northampton, exhorting the people in public places to forsake all vicious practices, drunkenness, swearing, etc., and to cultivate the Christian graces. He had a winning manner, and by his extreme earnestness made many converts. His followers were first contemptuously called "Quakers" in 1650. According to F.'s own account, given in his *Journal*, "This was Justice Bennet of Derby, who was the first that called us Quakers, because I bade them tremble at the word of the Lord." The name has been commonly explained from the Quakers' agitation when "moved by the Holy Ghost." In 1655, F. was brought to London, and examined before Cromwell, who quickly saw that there was nothing in Quakerism to excite his apprehensions, and pronounced the doctrines and the character of its founder to be irreproachable. Nevertheless, for some years after this, F. had a hard struggle with his Puritan antagonists. In an age of dogmatism and fanaticism, it was not to be expected that the half-mystical spiritualities and grotesque practical crotchets of the Leicestershire shoemaker could meet with any official toleration. F. was constantly vilified and frequently imprisoned by country magistrates. In 1669, he married the widow of judge Fell. He then went to America, where he spent two years in propagating his views with much success. On his return to England in 1673, he was imprisoned for some time in Worcester jail, under the charge of having "held a meeting from all parts of the nation for terrifying the king's subjects." On his release, he visited Holland, and afterwards Hamburg, Holstein, and Dantzic, always endeavoring to persuade men to listen to the voice of Christ within them. He died in London, Jan. 13, 1691. F. was not a man of broad and philosophic genius; he did not enrich the world with the multitude of his thoughts; in fact, there is a conspicuous poverty of intellect and sentiment manifested in his writings, but (as often happens in the case of a mystic) the earnestness and clearness with which, in the opinion of many, one great truth of Christianity was realized, imparted a power and efficacy to his words that genius itself might envy. His doctrine of the universal "inner light"—defended in a more learned fashion by Barclay (q.v.) in his *Apology for the Quakers*—may be regarded as a protest against the narrow or at least excessive "scripturalism" of his age, but his understanding was not sufficiently clear and strong to guide him safely in all the consequences which he ventured to deduce from it. Hence have sprung most of the *niaiseries* of Quakerism. His writings were collected and published in 3 vols., 1694–1706. An edition in 8 vols. has been published at Philadelphia, U. S.—Compare Sewel's *History of the Quakers;* Neal's *Puritans;* Marsh's *Life of Fox* (1848); and Janney's *Life of Fox, with Dissertations*, etc. (Phila. 1853).

FOX, Gustavus Vasa, b. Mass. 1821; entered the U. S. navy, 1838; served on various stations and in the coast survey, and in the war with Mexico. During the war of the rebellion he was assistant secretary of the navy, in which capacity he discharged the most delicate and responsible duties, with great efficiency and tact, and with no desire for public reputation. After the war, declining to avail himself of opportunities for promotion, he took charge of great woolen mills in Lowell, Mass.; and has since been in connection with a large business firm in Boston.

FOX, William Johnson, orator and political writer, the son of a small Suffolk farmer, who afterwards settled as a weaver at Norwich, was b. in 1786. He gave early promise of talent, and was sent to Homerton college, to be trained for the ministry of the independents. He subsequently seceded to Unitarianism, but ultimately shaking off all allegiance to existing Christian churches, he delivered a series of prelections at his chapel in South place, Finsbury, which marked him out as the leader and organ of English rationalism. When the anti-corn-law league enlisted the ablest platform orators of the day in the service of free trade, his bold and impassioned rhetoric greatly contributed to arouse and intensify public feeling. M. Guizot quotes his speeches as the most finished examples of oratory which the great conflict produced. Their effect upon the vast metropolitan audiences to which they were addressed was electric. F. also contributed by his pen to the success of free trade, and his *Letters of a Norwich Weaver Boy* were largely quoted and read. After the abolition of the corn laws, he was invited to stand for Oldham, which borough he continued to represent till 1863 since 1847. Like most men who enter the house of commons late in life, F. did not altogether realize the oratorical promise of his platform and pulpit career. His best parliamentary speeches were upon the education of the people. As a politician he was ever a consistent member of the advanced liberal party. A succession of illnesses in his late years interfered with his attendance in parliament. He was among the earliest contributors to the *Westminster Review*, edited for many years the *Monthly Repository*, and largely contributed to various other organs of public opinion. His *Lectures, chiefly addressed to the Working-Classes*, were published in 3 vols. He is the author of a philosophical dissertation on *Religious Ideas*, and other theological works. He died in 1864.

FOXE, John, the martyrologist, was b. of respectable parents in 1517, at Boston Lincolnshire. In 1533, he entered as a student at Brasenose college, Oxford; in 1538,

he took his bachelor's, and in 1543, his master's degree, and was elected a fellow of Magdalen college. He displayed at an early period an inclination for Latin poetry, and wrote several plays in that language upon scriptural subjects. Of these, the only one that remains, entitled *De Christo Triumphante*, was printed at London in 1551, and at Basel in 1556, 8vo, and 1672. The religious movements of the times led him to study the great controversy between popery and Protestantism, and becoming a convert to the principles of the reformation, he was, July 22, 1545, expelled from his college for heresy. His father being dead, and his mother married again, his step-father refused him any further aid, and he was, in consequence, reduced to great distress. For a short time, he was employed as tutor to the children of sir Thomas Lucy of Charlecote, Warwickshire, and afterwards was engaged by the duchess of Richmond as tutor to the children of her brother, the earl of Surrey, then a state prisoner in the Tower. In this capacity he remained during the whole reign of Edward VI., but was never, notwithstanding Anthony Wood's assertion to the contrary, restored to his fellowship at Magdalen. On June 23, 1550, he was ordained deacon by Ridley, bishop of London, and preached the doctrines of the reformation at Reigate. During the reign of Mary, he retired to the continent. On the accession of queen Elizabeth, he returned to England in Oct., 1559; and in May, 1563, he was inducted into the canonry and prebend of Shipton, in the cathedral of Salisbury. He also enjoyed the living of Cripplegate, which he soon resigned, and for a year he held a stall at Durham. In 1575, when some Dutch Anabaptists were condemned to the flames in London, F. interceded for them with queen Elizabeth and other persons in authority, but without effect. He wrote numerous controversial and other works, but the one that has immortalized his name is his *History of the Acts and Monuments of the Church*, popularly known as *Foxe's Book of Martyrs*, the first part of which was published at Strasburg in 1554. The first English edition appeared in 1563, in one vol. folio. Sanctioned by the bishops, it was ordered, by a canon of the Anglican convocation, to be placed in the hall of every episcopal palace in England, and has gone through innumerable editions. It is not a very critical work, as might naturally be supposed, and Roman Catholics deny its trustworthiness. F. died in 1587, in his 70th year, and was buried in the chancel of St. Giles's, Cripplegate, London.

FOXES AND FOX-HUNTING. The law with reference to fox-hunting, which is a matter of a good deal of importance in many parts of the country, seems to stand thus in England: "Though in general all persons who go upon another's lands without permission are trespassers in the eye of the law, yet there are some cases where the trespass is said to be justifiable," says Mr. Paterson, the most recent writer on the subject, and he quotes Blackstone's dictum to the effect that "the common law warrants the hunting of ravenous beasts of prey, as badgers and foxes, in another man's land, because the destroying such creatures is said to be profitable to the public" (3 Black. *Com.* 212). Care must be taken, however, that no damage be done beyond what is necessary for the public good, for that is the ground on which alone the legal character of fox-hunting can be maintained. It was found, moreover, in the earl of Essex *v.* Capel (1 Chitt. Game L. 114), that though pursuing a fox on another's land be justifiable, yet, if it take to earth, or to a house there, it is not justifiable to dig or break doors for it. In Scotland, where, from the character of the country, fox-hunting is often impossible, it never has become a national sport to the same extent as in England; and consequently, the rule that one is entitled to enter on the lands of another for the purpose of killing a fox, has been confined to those cases in which he is pursued simply as a noxious beast, and fox-hunting for sport without leave has been held to be punishable as a trespass, and the trespasser held liable for whatever surface-damage he may occasion. In Ireland (by 1 and 2 Will. IV. c. 32, s. 35), persons pursuing with hounds any fox, hare, or deer which has been started elsewhere on another's land, are exempted from summary proceedings for trespass.

FOX-GLOVE. See DIGITALIS.

FOX-HOUND, a kind of dog much used in Britain for the sport of fox-hunting. It is not quite so large as the staghound, and is perhaps a mixed breed between the staghound or the bloodhound and the greyhound. The color is commonly white, with large patches of black and tan color. Their speed and perseverance are remarkable; they have been known "to run hard for ten hours before they came up with and killed the fox, and the sportsmen were either thrown out, or changed horses three times."

FOX-HUNTING, from its exciting nature, as well as from the qualities of daring courage and cool calculation requisite in those who thoroughly follow and appreciate it, has long been termed the king of British national sports.

In Great Britain, there are upwards of 100 hunting establishments, of which by far the greater proportion belong to the counties s. of the Tweed. Fox-hunting establishments—which are in most instances supported by subscription, though sometimes owned by private gentlemen of wealth and influence—are organized and maintained at a very considerable annual cost, the price of a single pack of fox-hounds sometimes amounting to several thousand guineas. Every establishment is under the direct superintendence and control of one experienced gentleman, the *master*, and under him again rank the huntsman, whippers-in, earth-stopper, kennel-servants, etc. A "pack" is

composed of from 20 to 60 couples of hounds, the number greatly depending upon the frequency of hunting-days: thus, some packs hunt six days, some five days, others four, and many only two days a week; 30 couple of hounds is a good average; these are carefully reared, fed, and otherwise attended to. The master himself, as a matter of course, has the general superintendence of the servants, hounds, and horses; and in the hunting-field is general director of the proceedings. Next to him come the huntsman, and one or two "whippers-in" ("whips"). The huntsman, who is practically the most important personage in the field, requires to see that his hounds are properly managed and fed in their kennels; duly led to the place of meeting on hunting-days; and, what is of more consequence still, that they receive fair-play in the field, and find and hunt their foxes in true style. The huntsman requires to be a man of great nerve and much activity: he should also have a good head, a clear ringing voice, a keen eye, and above all he must be a first-rate horseman, and know thoroughly every point in the country over which he hunts. He has often to restrain heedless riders, and "keep the field back;" a duty requiring firmness of character, with a quiet and civil manner. With these necessary qualifications, and having so many responsible duties on his shoulders, he is treated with great respect by those for whom he provides sport: he is mounted on the best horses his master can produce, and may be said to conduct and direct the hunt from the moment the fox is found till the moment of its death—from "find to finish."

The duties of the first whipper-in, though not so responsible as those of the huntsman, are still considerable: for instance, he takes a certain management of the hounds in kennel, assists in conducting the hounds to the "meet," and aids the huntsman in various ways during the run. His knowledge of the management of hounds, and of fox-hunting generally, must at the same time be such as to enable him to occupy the huntsman's place in an emergency. The "second whip's" principal duty is that of bringing up and urging on lagging hounds in the field, by lashing and "rating." In many hunts, however, a second whipper-in is dispensed with.

A considerable range of country is necessary for the full enjoyment of fox-hunting, the best being that which is diversified by pasturage and plantation. Being a nocturnal feeder, the fox quits his burrow or "earth"—which is generally in a gorse brake, or a plantation or covert of underwood—during the night, and returns to it in the morning, and this fact is taken advantage of by those who hunt him for sport. The day and place of "the meet" are duly advertised, and on the night before the hunt, the coverts to be "drawn" next day are visited either by a duly appointed *earth-stopper* or by the gamekeeper, who, knowing that the foxes are from home, proceeds, spade in hand, from one hole to another, filling them up with earth and brushwood as he goes. Thus, the fox, upon returning at dawn to his "earth," finds ingress denied, and so betakes himself to some neighboring thicket, or to some uninclosed cover of gorse, rushes, etc., where he makes a temporary lair or "kennel." When the earths have been carefully closed, the earth-stopper returns home and informs the huntsman, or first "whip," as to their number and locality, and that information forms a guide for the proceedings of the following day. (After the hunt is over, the earths are reopened, and as little trace as possible left of the work.) The hour of "the meet" is usually 10 or 11 o'clock A.M., and at the appointed place assemble the whole field, including master, huntsman, whippers-in, hounds, and those gentlemen (and frequently ladies) who intend either to participate in the day's sport, or merely to see the "hounds throw off." When a covert is reached, the huntsman, by a wave of his hand, or a few familiar words, such as "Eu in! eu in there! good dogs!" "throws in" his hounds, following immediately after with the first "whip." The mounted gentlemen usually remain outside, and take their directions as to stance, etc., from the master, who from this time forward does his best to control and direct their movements. In fact, the master may be said to have the control of the "field"—that is, the riders—and the huntsman that of the hounds and hunt. The second whip being posted at the covert side, near where it is expected a fox may burst through or "break," one or two of the more eager riders are sometimes permitted to jump their horses into the covert, if it be large, to assist in the finding of the fox. Those who remain outside then prepare themselves for their work, and eagerly listen for the first token of the presence of reynard; this is betrayed by a slight but anxious whimper or whine from the "challenging" hound—that is, the hound (usually an old and experienced one) that first perceives or "hits" the scent of a fox —and is soon followed by others, who instantly rush to his side. The huntsman, if he be tolerably certain that the game scented is no other than a fox, at judicious intervals urges on his hounds by familiar expressions, such as "Yoicks, yoicks, have at him!" "Push him up!" etc., till the fox is fairly roused from his kennel, and steals away. It sometimes happens, while "drawing" coverts, that hounds will come suddenly upon a fox, and seize him before he has time to escape. This is termed "chopping," and is always to be prevented if possible. If the covert be very thick, a fox may leave his kennel unperceived; and when he does so, he usually runs through or round the covert for a considerable distance before quitting it for the open fields. He may also "run his foil," by doubling back and forward on the same path or track, and thus possibly baffle the hounds, even when they "own his scent." In large coverts, too, a fox frequently "hangs;" that is, he remains in it for a long time before going away. The person who first sees the fox "break cover," or, in other words, "views him away," should

always allow him a certain "law" before giving the "view halloo," as a fox will frequently turn or "head back" into covert if he hears any unusual noise at the instant of his quitting it. When, however, the person or persons who are watching see that the fox is really off, notice is instantly given to those within the thicket, and those without, by the cry of "Hou—y! hou—y! Tallyho! *Gone away!* GONE A-WAY!!" upon which the huntsman blows his horn to collect his hounds; the whipper-in drives out lagging members of the pack, either with his whip or by some cry; the master restrains the more impatient of the riders till the huntsman and hounds have "settled to" their fox; and then he and the entire field join in the chase, and the first, and frequently the most exciting, part of the day's proceedings has commenced—the fox has "broke cover," the hounds have been "laid on," and the field has entered on its impetuous "first burst." A certain etiquette is, however, absolutely necessary in allowing the hounds and huntsman to get away *first;* but after that, each rider, with a certain deference to the master, chooses his own place in the hunt, and does his best, independently of his neighbors, to keep at a certain distance, not directly in the line, but to one side and in the rear of the hounds. When a rider happens to be near the pack at the first burst, and gets a good position in following them, he is said to "get well away with the hounds;" and if well mounted and a skillful rider, his chances of both viewing the hunt and being "in at the death" are very considerable. And now, as we have already said, begins the grand excitement of the day; the fox being fresh, races away at tremendous speed, followed by perhaps upwards of twenty couple of hounds at full cry. If the day is propitious (a "southerly wind and cloudy sky" having long retained favor), the scent of the retreating fox lies well, especially at first, when it is called "burning" or "breast high," and is for many minutes "owned" by at least all the leading hounds in the pack, though, perhaps, the object of pursuit itself is far ahead, and ought of sight; and away streams the hunt over hedges, ditches, and gates, across rivers, railways, arable land, and grass pastures, perhaps for several miles before a single *check* occurs. Now, the foxhound hunts almost entirely by scent, and does not, like the greyhound, depend upon the eye. The fact of scent failing, therefore, at any time during the hunt, throws out the hounds, and prevents them from renewing it, until the scent is recovered, or "hit off." When the scent is "burning," hounds run almost mute, though at first, and at intervals afterwards, they usually "throw their tongues" pretty freely. When all the hounds are giving tongue, they are said to be at "full cry," and "carry a good head," the scent being on such occasions so thoroughly diffused as to be felt or "owned" breast high by probably every member of the pack. Sometimes scent becomes so faint as to be hardly perceptible, and when this is the case, the energy of the hounds abates considerably; they then run with their heads close to the ground, and are said to hunt a "cold" scent. Here, however, a little timely assistance from the huntsman is of the greatest moment in restoring animation to the pack. He waves his cap, blows his horn, and encourages his hounds, by well-known expressions, to renewed exertions. When, as frequently happens from various causes, the scent fails entirely—such as the fox crossing water, running through a drove of sheep, "heading back" in another direction, running along or lying upon the tops of walls or thick hedges, etc.—the hounds cease "giving tongue," suddenly stop, throw up their heads, and are "at fault." In this emergency, the "field" remains at a respectful distance behind, and the huntsman knowing, or at least guessing by experience which way the fox has taken, or the special means he has adopted for foiling the scent, allows his hounds at first, for a few moments, themselves to attempt to regain it; but failing that, and finding that his interference and assistance are necessary, he instantly blows his horn, and calls or "lifts his hounds" from the place, and "takes a cast" round and round about the spot where the scent failed, cheering them on the while. Thus, by gradually widening his casts, the scent is very frequently recovered or "hit off," a circumstance which is soon made apparent by the whimper of recognition given by the hound that first "owns it," followed by the answering tongues of the whole pack. When the hounds, however, fail to "hit off" the scent, if the day be far advanced, they are taken home, or they are trotted on to some neighboring covert, which is drawn for a fresh fox.

When the fox is killed, either in "the open" or elsewhere, the rider who is first in at "the death"—usually the huntsman—springs off his horse with a "whoo! whoop!" lashes the hounds off, and cut off the head, feet (*pads*), and tail (the *brush*). He then flings the carcass to the hounds, who tear it to pieces, and devour it in a very few minutes. The brush is usually presented to any lady who may happen to be in at the death, or is claimed as a trophy by one or other of the gentlemen present. The *pads* likewise are distributed amongst those who may wish to preserve mementos of the chase. As a general rule, the huntsman, and several of the best mounted in the field, manage to be in, either at or immediately after the death, though instances are not wanting when, during unusually protracted runs, the hounds have left every rider far behind, and have followed and killed their fox miles away from the spot where the last horseman had given in. A strong fox will frequently "live" before hounds for an hour or an hour and a half; but cases have been known when this has been far exceeded, and when the run has extended to 30 or even 40 m., and has lasted all day, and even into the night. Young foxhounds begin their career by what is termed *cub-hunting;* but this, however necessary it may be for teaching them, is considered inferior sport to regular hunting.

The midland counties of England, such as Leicester, Northampton, Warwick, Yorkshire, etc., are the best for hunting purposes in Great Britain; and owe their superiority in a great measure to two causes: 1st, the strict preservation and consequent number of foxes; and 2d, the extensive tracts of pasturage being favorable both for running and scent. The instinct of the fox leads him, as a general rule, to run *down* wind, that his scent may not be blown *to* the hounds; he also takes advantage of every peculiarity in a country likely to offer him an advantage over his foes.

The fox-hunter must be possessed of considerable courage, united with coolness, and must be a judge of pace and have a good eye in "riding to hounds," to avoid tiring or "overmarking" his horse unnecessarily. Much of the excitement and pleasure of the fox-hunter consists in his successfully leaping the various hedges, ditches, fences, etc., encountered; but at the same time, a really skillful and humane rider, however well mounted, will never knowingly urge his horse at a fence or leap of any kind, unless he is positively certain it is within his horse's power; and if he finds his horse betrays symptoms of distress, he will rather turn its head homewards, and forego the chase, than overtax its courage and strength.

Much useful and entertaining information on fox-hunting occurs in Blaine's *Encyclopædia of Rural Sports* (London, Longmans); *British Rural Sports*, by Stonehenge; Beckford's *Thoughts on Hunting; Reminiscences of a Huntsman; Nimrod; The Field* newspaper; etc.

Fox-hunting is not practiced after the English fashion in the northern states of America, but in the southern states from Maryland to Florida, it is a favorite amusement. The object of pursuit, however, is the *gray fox* (*vulpes Virginianus*), and the chase is not so severe, and seldom lasts so long as that of the common fox.

FOX INDIANS. See SACS and FOXES.

FOX ISLANDS, another name for the Aleutian Islands (q.v.).

FOX RIVER is the name of two considerable streams in the United States of America, both of them rising in Wisconsin.—1. The F. R., or *Pishtaka*, is an affluent of the Illinois, which is itself a tributary of the Mississippi. It is 200 m. long, and is valuable chiefly for its water-power.—2. The F. R., or *Neenah*, after a course of about the same length, falls into Green bay, in lake Michigan. It is divided into two sections by lake Winnebago, the upper one being connected by a canal with the Wisconsin, so as to link together the Mississippi and the great lakes of the St. Lawrence.

FOX SHARK, or THRESHER, *Alopias* or *Alopecias*, a genus of sharks, containing only one known species (*A. vulpes*), an inhabitant of the Mediterranean and the Atlantic, and occasionally seen on the British coasts. The snout is short and conical; the spout-holes are very small; the mouth is not so large as that of the white shark, nor the teeth so formidable; but the F. S. is extremely bold and voracious, readily attacking grampuses or dolphins much larger than itself. Its most remarkable peculiarity is the great elongation of the upper lobe of the tail-fin, which is nearly equal in length to the whole body, and into which the vertebral column extends. Of this it makes use as a weapon, striking with great force. It is said to be not uncommon for a whole herd of dolphins to take flight at the first splash of the tail of a fox shark. From the use which it makes of its tail, it has acquired the name of thresher. It attains a length, tail included, of 18 feet. The body is spindle-shaped.

FOXTAIL GRASS, *Alopecurus*, a genus of grasses, distinguished by a spiked panicle, two *glumes* nearly equal, and generally united at the base, inclosing a single floret which has a single *palea*, with an awn rising from the base. The species are chiefly natives of temperate countries, and about six are British. MEADOW FOXTAIL GRASS (*A. pratensis*), which has an erect smooth culm about 1½ to 2 ft. high, and a cylindrical obtuse panicle abundantly covered with silvery hairs, is one of the best meadow and pasture grasses of Britain, but does not arrive at full perfection till the third year after it is sown. It bears mowing well, and is reckoned a good grass for lawns. It bears drought well. The JOINTED FOXTAIL GRASS (*A. geniculatus*), with an ascending culm bent at the joints, is very common in moist places, and cattle are fond of it, but it is a small grass. The SLENDER FOXTAIL GRASS (*A. agrestis*) is an annual or biennial, of little value except for light sandy soils, on which it is sometimes sown. A foreign species (*A. nigricans*), a native of the continent of Europe and of Siberia, has been introduced into Britain, and appears likely to prove valuable. It has somewhat creeping roots, is a little larger and stronger than *A. pratensis*, and is rather earlier.

FOY, MAXIMILIEN SÉBASTIEN, a distinguished French gen. and orator, was b. at Ham, 3d Feb., 1775. In 1791, he was one of the volunteers who hastened to defend the frontiers of their country against foreign invasion, and during the next nine years served with distinction under Dumouriez, Moreau, and Massena. In 1800, he was raised to the rank of adj.gen. in the division of Moncey, in the army of the Rhine, which marched through Switzerland into Italy, where he commanded the vanguard of the army in 1801. In 1805, he commanded the artillery of the second division in the Austrian campaign. In 1807, Napoleon sent him to Turkey at the head of 1200 artillerymen, to assist sultan Selim against the Russians and British. After the revolution in which Selim was dethroned, F., under the direction of the French ambassador, gen. Sebastiani, defended

Constantinople and the strait of the Dardanelles so effectively, that Duckworth, the British admiral, was obliged to retire with loss. From 1808 to 1812, F. was gen. of division of the army in Portugal. His talents were exhibited to advantage in conducting the retreat of the French army across the Douro. F. was present at all the battles of the Pyrenees, and at Orthez, in 1814, was dangerously wounded. In the campaign of 1815, he commanded a division on the field of Waterloo, where he was wounded for the fifteenth time. In 1819, he was elected deputy by the department of Aisne. In the chamber he was the constant advocate of constitutional liberty, and showed great rhetorical talent and knowledge of political economy. He distinguished himself particularly by his eloquence in opposing the war against Spain in 1823. F. d. at Paris, Nov. 28, 1825. Mme. Foy published, in 1827, from her husband's papers, a *Histoire de la Guerre de la Péninsule*. In the previous year appeared his *Discours*, with a biography.

FOY'ERS, a stream rising in the Monadleadh mountains, in the middle of Inverness-shire. It runs 12 m. n., and falls into the e. side of loch Ness, nearly opposite Meal-fourvounie mountain. It has two celebrated falls within a mile and a half of its mouth, where the stream rushes through a deep, narrow ravine in the hills, skirting the e. side of the loch. The upper fall is 30 ft. high. The stream then descends 30 ft. in a quarter of a mile. The lower fall (specially called *The Fall of Foyers*) is 90 ft. high. It is one of the finest cascades in Britain.

FOYLE, Lough, an inlet of the Atlantic, on the n. coast of Ireland, between the counties of Derry and Donegal. It is triangular in form, 16 m. long from n.e. to s.w., 1 m. wide at its entrance, and 9 m. broad along its s. side. A great part is dry at low water, and its w. side alone is navigable. Vessels of 600 tons ascend the w. side of the lough, and its chief tributary, the Foyle (which comes 16 m. from the s.), to Londonderry. On the e. shore is a flat strand with a sandy beach, on which, in 1827, was measured a line of 41,640, which was afterwards extended by triangulation to about 58,200 ft., and formed the base line of the ordnance survey of Ireland.

FRA BARTOLOMEO. See Baccio della Porta.

FRACASTORO, Girolamo, an Italian savant and philosopher, famous for the universality of his learning, was b. of an ancient family at Verona in 1483. At the age of 19 he was appointed professor of logic in the university of Padua. But his vast knowledge embraced the most divergent sciences, and on account of his eminence in the practice of medicine, he was elected physician of the council of Trent. His Latin verse also exhibits remarkable elegance. He d. in 1553. A bronze statue was erected in his honor by the citizens of Padua, while his native city commemorated their great compatriot by a marble statue. His writings in prose and verse are numerous. The chief are: *Syphilidis, sive Morbi Gallici* (Verona, 1530, in 4to; Paris, 1531 and 1539, in 8vo; London, 1720, in 4to, and in 1746, in 8vo; Italian edition, Verona, 1739, in 4to, by Tiraboschi; Naples, 1731, by Pietro Belli); *De Vini Temperatura* (Venice, 1534, in 4to); *Homocentricorum sive de Stellis, de Causis Criticorum Dierum Libellus* (Venice, 1535, in 4to); *De Sympathia et Antipathia Rerum, De Contagionibus et Contagiosis Morbis, et eorum Curatione* (Venice, 1546, in 4to; Lyons, 1550, 1554, in 8vo). The collective works of F. appeared for the first time, Venice, 1555, in 4to.

FRACTED, heraldically, signifies broken asunder.

FRACTION. In arithmetic, a fraction is any part or parts of a unit or whole, and it consists of two members, a denominator and a numerator, whereof the former shows into how many parts the unit is divided, and the latter shows how many of them are taken in a given case. Thus $\frac{3}{4}$ denotes that the unit is divided into four parts, and that three of them are taken; and more generally $\frac{a}{b}$ denotes that the unit is divided into b parts, and that a of them are taken. A fraction is called *proper* when the numerator is less than the denominator, and *improper* when the numerator is greater than the denominator. In algebra, any quantity $\frac{a}{b}$ is called a fraction, although a and b are not necessarily representatives of whole numbers, as they would require to be if the fraction be an arithmetical fraction. The algebraical fraction $\frac{a}{b}$ just means that any quantity affected by it is to be *multiplied* by a, and *divided* by b. This definition, however, through the greater generality of algebra, includes that of an arithmetical fraction. The rules for the addition and multiplication of fractions are the same in algebra and arithmetic. To add two or more fractions together, we must bring them to a common denominator, and add the numerators for a new numerator, and take the common denominator for the new denominator. Thus if $\frac{a}{b}$, $\frac{c}{d}$ be two fractions, then $\frac{a}{b}+\frac{c}{d}=\frac{ad}{bd}+\frac{cb}{bd}=\frac{ad+bc}{bd}$, the fractions being brought to a common denominator by (as a general rule) multiplying each numerator by every denominator, except its own, and multiplying all the denominators for the common denominator. To subtract two fractions, we bring them to a common denominator, and subtract their numerators for the new numerator. Thus

$\frac{a}{b} - \frac{c}{d} = \frac{ad - bc}{bd}$. To multiply two fractions together, the rule is, to multiply the numerators together for a new numerator, and the denominators together for the new denominator. Thus $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$. The reasons for all these rules are obvious. The rule of division is to invert the divisor, and proceed as in multiplication. This follows from the consideration, that to *divide* is the inverse of to multiply, and that to divide by $\frac{a}{b}$ must be the same thing as to multiply by $\frac{b}{a}$.

FRACTIONS, CONTINUED. If $\frac{A}{B} = a + \frac{a_1}{B}$, and $\frac{B}{a_1} = b + \frac{b_1}{a_1}$, and $\frac{a_1}{b_1} = c + \frac{c_1}{b_1}$, and $\ldots \frac{k_1}{l_1} = m + \frac{m_1}{l_1}$, and $\frac{l^1}{m_1} = n + \frac{n^1}{m_1}$, etc.

$$\text{Then } \frac{A}{B} = a + \cfrac{1}{b + \cfrac{1}{c + \cfrac{1}{d + \cdots \cfrac{\cdots 1}{m + \cfrac{1}{n + \cdots}}}}}$$

This expression for the value of $\frac{A}{B}$ is called a continued fraction. If we consider the fractions (1) $\frac{a}{1}$, (2) $a + \frac{1}{b}$ or $\frac{ab+1}{b}$, (3) $a + \cfrac{1}{b + \cfrac{1}{c}}$ or $\frac{(ab+1)c + a}{bc+1}$, formed by taking into account parts only of the denominator in the continued fraction, we obtain a series of fractions *converging* to the value of $\frac{A}{B}$. These converging fractions are always approximating to the value of $\frac{A}{B}$, and are alternately greater and less than it. Throughout the series, the 1st, 3d, 5th, 7th, etc., are each below the true value, while the 2d, 4th, etc., are above it; or *vice versa*, according as the original fraction is improper or proper. It can be shown that the successive converging fractions approach nearer and nearer to the true value of the continued fraction. Converging fractions are of great use in the summation of infinite series.

In illustration of the above general statement, let us take the numerical fraction $\frac{6935}{2151}$, which we first reduce to a continued fraction in the following manner: $\frac{6935}{2151} = 3 + \frac{482}{2151} = 3 + \frac{1}{\frac{2151}{482}} = 3 + \cfrac{1}{4 + \frac{223}{482}}$ = (by continuing the same process)

$$3 + \cfrac{1}{4 + \cfrac{1}{2 + \cfrac{1}{6 + \cfrac{1}{5 + \cfrac{1}{7}}}}}$$

or, as it is now commonly written, $\frac{3}{1} + \frac{1}{4} + \frac{1}{2} + \frac{1}{6} + \frac{1}{5} + \frac{1}{7}$. Here the first convergent is 3; the second, $\frac{3}{1} + \frac{1}{4} = \frac{13}{4}$; the third is $\frac{3}{1} + \frac{1}{4} + \frac{1}{2} = 3 + \frac{2}{9} = \frac{29}{9}$; and finding the other convergents in a similar manner, we have the following approximations to the value of the original fraction

$$3, \frac{13}{4}, \frac{29}{9}, \frac{187}{58}, \frac{964}{299}, \frac{6935}{2151}.$$

The differences between the successive convergents and the original fraction are,

$$\frac{6935}{2151} - 3 = \frac{482}{2151} \left(\text{being less than } \frac{1}{1 \times 4}\right),$$

$$\frac{13}{4} - \frac{6935}{2151} = \frac{223}{8604} \left(\text{being less than } \frac{1}{4 \times 9}\right), \text{ etc.;}$$

and in general the difference between any convergent and the original fraction is less than a fraction $= \frac{1}{\text{denom. of convergent} \times \text{denom. of conv. next greater}}$; consequently, the differences grow less as we proceed, owing to the denominators of the convergents

always increasing. If, by actual subtraction, we find successively the difference between each convergent and the original fraction, we shall also find that they are alternately greater and less, or less and greater, according as the original fraction is proper or improper.

FRACTIONS, VANISHING. In some algebraical fractions, the substitution of a particular value for the unknown quantity will make both the numerator and denominator of the fraction vanish; such fractions are called vanishing fractions. Thus, the fraction $\frac{x^2-1}{x-1}$ assumes the form $\frac{0}{0}$ when $x = 1$. The ascertainment of the value of such a fraction for the particular value of the unknown quantity which gives it the form $\frac{0}{0}$, may in all cases be effected by a general method furnished by the differential calculus. But frequently that value may be determined by simpler means, as the form $\frac{0}{0}$ arises from the existence of a factor common to both numerator and denominator, which becomes zero for a particular value of x; if, then, we car discover this factor either by finding the greatest common measure or otherwise, and divide it out, then by substitution we obtain the value of the fraction corresponding to the particular value of x. Thus, in the example given, we find that both terms are divisible by $x-1$, so that $\frac{x^2-1}{x-1} = x + 1$. Therefore, when $x = 1$, and the fraction becomes $\frac{0}{0}$, its value must equal 2. This is an example of the application of the method of limits to the determination of the value of such a fraction, for it is clear that for every value of $x > 1$, the value of the fraction is > 2, and continually approaches 2 as x approaches 1. Much discussion has taken place as to whether vanishing fractions have, properly speaking, values or not; but this is not the place for noticing speculations on the subject. See LIMITS, THEORY OF; and NOTHING, and INFINITY.

FRACTURE of a bone may be the result of accident, muscular action, or disease. The long bones of the limbs are more subject to the latter two causes than those of the head or spine. *Predisposing causes* to fracture are frosty weather, old age, cancerous disease, a morbidly brittle condition called *fragilitas ossium.*

Some bones, as the kneepan and heel-bone, are liable to give way from sudden contraction of the muscles which are inserted into them. The subject of the injury then falls, and attributes the accident to the fall, whereas it is the reverse. A medical man, some few years ago, awoke with a fit of cramp, and almost immediately his left thigh-bone broke with a snap. It reunited in the usual time. The sufferer from cancer of long standing, sometimes feels a bone give way under no special strain. In such cases, there is seldom any attempt at repair. The bones of old people are brittle from the excess of earthy materials (see BONE), and so readily give way. The bones of the feeble patient, with fragilitas or mollities ossium, are soft and friable, and when examined, are found saturated with a greasy substance.

There are some persons who seem liable to fracture without any such reason. Prof. Gibson of America mentions a boy who, though apparently healthy, had broken his collar-bones eight times, his arm and forearm, while his leg and thigh were broken if he but tripped his foot on the carpet. An old lady once broke both thigh-bones kneeling down in church. There is one predisposing cause to fracture fortunately now but seldom seem—viz., scurvy. Not only did it make the bones brittle, but, as was seen in lord Anson's expedition, which was manned chiefly by pensioners, old fractures again became disunited.

Repair of a Broken Bone.—Of course, as the bone lies in the midst of soft parts, any injury to the one must tear the other, and cause an infusion of blood; but the latter is speedily absorbed, and is of no service in the process of repair. After the first excitement has passed off, a fluid is effused around the fragment, which in a short time becomes converted into bone. The amount of this new material depends upon the position of the fragments; should they be far apart, or, as it is technically termed, riding, then a much larger quantity of new bone is thrown out. We see this in animals to such an extent that the materials for repair, or "callus," may be divided into two separate parts—a provisional callus to act as a wrapper to the bones until the permanent callus, or that which unites the ends, however far apart, becomes sufficiently hard; then the provisional callus, being no longer necessary, is removed by absorption.

Symptoms of Fracture. A broken limb hangs loose, and is, as a general rule, no longer under the control of the muscles, which, however, are pricked by the broken ends of bone, and stimulated into painful spasms, which still further displace and deform the limb. Should there be any doubt, the limb may be carefully raised, and turned gently from side to tide, when a peculiar rough feeling termed *crepitus* removes all doubt. Each bone, however, when broken, exhibits symptoms peculiar to itself, and requires a separate treatment.

Fractures are divided into *simple*, when there is no wound in the skin which communicates with the fracture; *compound*, when there is such a wound; *comminuted* being prefixed to either of these terms when the bone is broken into several pieces; *impacted*, when one fragment is driven into the other; and *complicated*, when a neighboring joint or large blood-vessels participate in the accident.

Treatment of Fracture.—Replace the fragments as near as possible to their former positions by gentle extension, retain them in place by substituting an *external* rigid skeleton, made of any unyielding material which will be firm enough to resist the spasms already alluded to, but is not fastened with very great tightness to the limb. *Splints* are generally of wood or pasteboard; but of late years gutta percha has been much used. In simple fractures, it is often sufficient to adapt a bandage to the limb, which will harden on drying, and form a *shell* for it; for this purpose, starch, dextrine, and plaster of Paris are generally used. Whatever the splint be made of, it must keep the bones in a state of *complete rest*, otherwise the lymph, which would be formed into bone, stops, as it were, half way, and becomes fibrous tissue, which allows the fragments to move on each other, and is termed a false joint.

FRA DIAV'OLO, properly MICHELE PEZZA, a celebrated brigand and renegade monk, b. in Calabria in 1760. Of plebeian origin, he at first followed the trade of stocking-weaver, then entered the Neapolitan army, and subsequently the service of the pope; finally, he abandoned military life, and became a monk, but being expelled for misconduct, he withdrew to the mountains of Calabria, where he headed a band of desperadoes, whose strongholds lay chiefly in the district between Itri and Terra di Lavoro. Pillage, bloodshed, and atrocious cruelties, signalized his career. For years he evaded the pursuit of justice by retiring to his haunts amidst mountains and forests, and skillfully defeating, with much inferior numbers, all the armed forces dispatched against him. He became at length known among the peasantry of the neighborhood as Fra Diavolo. On the advance of the French into the Neapolitan states, F. D. and his band espoused warmly the royal interests, and in return, were not only pardoned and reinstated in civil rights, but promoted to the grade of officers in the royal army, F. D. himself becoming colonel. In 1806, he attempted to excite Calabria against the French, but was taken prisoner at San Severino, and was executed at Naples in Nov. of the same year. The opera of Auber has nothing in common with F. D. but the name. He died uttering imprecations on the queen of Naples and the British admiral, Sidney Smith, whose influence had not sufficed to rescue him from death, although on his capture he produced papers bearing the royal seal, which vouched for his right to the rank of col. in the royal forces.

FRA'GA, a t. of Spain, in the province of Saragossa, 63 m. w. by s. from Saragossa, on the left bank of the Cinca, which is crossed by a suspension bridge. The town stands on a slope, and is poor and half-ruinous, with ill-paved streets. The environs abound in pomegranates and figs. The small green figs of this district are celebrated as particularly delicious, and when dried form the chief article of export. F. is supposed to occupy the site of the ancient *Gallica Flavia*. Pop. 5,028.

FRAGA'RIA. See STRAWBERRY.

FRAME, in gardening, the covering of any kind of hot-bed, flued pit, or cold pit, used for the cultivation of plants not sufficiently hardy for the open air. Frames are of various materials, but generally of wood or iron and glass, and are made in one piece or in sashes according to the size of the hot-bed or pit.

FRAME-BRIDGE, a bridge built of timbers framed together in such a manner as to obtain the greatest possible amount of strength with a given quantity of material.

The fundamental principle upon which all such construction is based, is that the timbers shall be so arranged that the weight put upon them shall exert a pulling or a crushing strain, instead of a transverse strain, and, if possible, that the greatest strain shall act as a direct pull in the direction of the fibers of the wood. The construction of a frame-bridge is very similar to that of a roof, excepting that in the bridge a considerable outward thrust upon the abutments is generally permissible, while the walls of a house will not stand this; and that for the bridge a nearly level way on the top is desirable, while for a roof a steep incline is not objectionable, or is even desirable. In a simple and useful form of frame-bridge, the weight upon the bridge will exert a pulling strain upon a horizontal timber, and a crushing strain upon oblique timbers which extend from the extremities of the horizontal timber to the abutments, as well as upon the upper timbers; the main support is in the horizontal timber, which must be torn asunder before the oblique timbers can be bent or displaced to any considerable extent.

The celebrated frame-bridge of Schaffhausen, constructed in 1757 by Grubenmann, a village carpenter, was built exactly in the manner of a roof with a horizontal pathway superadded. It was composed of two arches, one 193 ft., the other 172 ft. span. It was merely laid upon the piers, and did not abut against them to exert any outward thrust. The weight on the bridge is transmitted by the oblique beams, which by analogy we may call *rafters*, to the tie beam, where it exerts a horizontal pulling strain. These rafters are framed into the tie-beam so as to abut firmly against it in the same manner as roof-rafters (see ROOF). This kind of frame-bridge is very common in Switzerland, where timber-bridges abound; and it has doubtless originated from the fact, that most of the bridges have been built by the local carpenters, who are accustomed to the construction of roofs of considerable span for the commodious square-built wooded cottages with overhanging roofs, so common in that country. Frame-bridges of more

complex structure are sometimes built; in some of these, the timbers are framed so as to present an arched form. In these cases, the structure is very similar to those described under CENTERING. The serious defect of all such bridges is their liability to decay from exposure to moisture, etc., especially at the joints, where water is apt to lodge and remain, from want of free circulation of air to evaporate it. In the bridge of Schaffhausen above described, it was found that when it had stood but 26 years, the oak-beams, where they rested on the masonry, were rotted, and the frames began to settle. This was remedied by a carpenter named Spengler, who raised the whole structure upon piles by means of screw-jacks, and replaced the decayed wood. Means should be adopted to admit the free circulation of air in those parts where the timber rests upon the masonry, and to prevent water from settling in the timber joints. The covered bridges of Lucerne and other parts of Switzerland are well known as objects of special interest to tourists, who usually imagine that the roofs are made for the comfort of travelers, but their main object is the preservation of the bridge.

In the watch-trade, the man who frames all the parts together, and builds up the watch, is called a finisher, and his work is called finishing, though it corresponds with what is called framing in other trades.

FRAMING, the jointing, putting together, or building up of any kind of artificers' work. The framing of timber generally is described under CARPENTRY, and special kinds of framing under CENTERING, DOOR, FLOORS, FRAME-BRIDGE, PARTITIONS, ROOFS, etc. In such trades as mathematical, optical, philosophical, and other complex instrument-making, the workman who does flat-filed work, and fits all the parts, and puts the whole instrument together, is called the *framer*, and his work *framing*.

FRAMINGHAM, a t. in Middlesex co., Mass., on Sudbury river, and Cochituate lake, and the Boston, Clinton, and Fitchburg railroad; 24 m. w. of Boston; pop. '70, 4,960. Its agriculture is important; and it has manufactures of cars, coaches, hats, bonnets, woolens, etc. There are several churches, a state normal school, and many good public schools.

FRAMLINGHAM, or "Strangers' Town," a t. in the e. of Suffolk, on the left bank of the Ore, 14 m. n.n.e. of Ipswich. It consists of a large market-place, from which a few streets irregularly branch out. The church is built of black flint and stone, and contains the monuments of Thomas Howard, third duke of Norfolk, and of his duchess, and of the unfortunate Henry Howard, earl of Surrey, and of his countess. Here are the remains of a castle with 13 square towers, where queen Mary retired after the death of her brother, Edward VI. Pop. '71, 2,569.

FRA MOREA'LE, or MONTREAL D'ALBANO, d. 1354; a native of Provence, distinguished himself in the service of Louis I. of Hungary in the war with Naples about the middle of the 14th century. At the conclusion of the war he became the chief of a body of brigands, but was soon driven out of the kingdom. He afterwards assisted or opposed this or that petty sovereign, and kept Italy in perpetual terror for a long period. He had at times from 8,000 to 10,000 troops, and showed great ability as a leader and organizer of his rough, plundering bands. He forced from Florence a tribute of 28,000 florins, and from Pisa 16,000; and seems to have had an ambitious purpose of establishing a permanent dominion. Finally, while in Rome, he was arrested by order of Cola di Rienzi, convicted of brigandage, and beheaded. Bulwer pictures him in his novel *Rienzi*.

FRANC, a French silver coin and money of account, which (since 1795, when it supplanted the livre Tournois) forms the unit of the French monetary system, and has also been adopted as such by Belgium and Switzerland. The F. is coined of silver, nine tenths fine, and weighs five grams, its value being about $9\frac{1}{2}d$. One pound sterling = 25.2 francs. The F. is divided into 100 centimes, but the old division into 20 sous is still made use of in common life. There are in France silver coins of $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, and 5 francs; and gold pieces of 20 and 40 francs. Italy has also adopted the French money system, only that the F. is called *lira nuova*.

FRANCAVIL'LA, a t. of Italy, in the province of Lecce, is situated on an elevation 22 m. s.w. of Brindisi. It is well built, has a college, three hospitals, and several convents; has manufactures of woolens, cottons, and earthenware, and, with its dependent villages, has a pop. of 17,300.

FRANCE, the most westerly portion of central Europe, extends from 42° 20′ to 51° 5′ n. lat., and from 8° 15′ e. long. to 4° 54′ w. long. It is bounded on the n. by the channel and the straits of Dover, which separate it from England, by Belgium, the grand duchy of Luxemburg, and the Rhenish provinces of Prussia; on the e. by the lately annexed German provinces of Alsace and Lorraine, by several of the Swiss cantons, and by Italy; on the s. by the Mediterranean and the dominions of Spain, from which it is separated by the Pyrenees; and on the w. by the Atlantic (the bay of Biscay). The greatest length of F., measured from Dunkirk in the n. to the Col de Falguères in the s., is about 620 m.; and its greatest breadth, from e. to w., measured from the new boundary line in the Vosges to cape St. Matthieu, in Finisterre, is about 550 miles. Its circumference, inclusive of sinuosities, is estimated at nearly 3,100 m., or 5,000 kilometers, of which nearly the half is composed of maritime coast-lines, which are sub-

Old Provinces.	Chief Towns.	Departments.	Area in Hectares.	Population in 1872.
		1. Seine	47,500	2,220,060
		2. Seine-et-Oise	560,337	580,180
1. Ile de France	Paris	3. Seine-et-Marne	558,575	341,490
		4. Oise	583,067	396,804
		5. Aisne	735,747	552,439
		6. Ardennes	525,747	320,217
2. Champagne	Chalons-sur-Marne	7. Marne	818,038	386,157
		8. Marne (Haute)	625,403	251,196
		9. Aube	602,212	255,687
		10. Meuse	621,618	284,725
3. Lorraine	Nancy	11. Meurthe-et-Moselle	650,000	365,137
		12. Vosges	550,000	392,988
4. Flanders		13. Nord	567,863	1,447,764
5. Artois	Lille	14. Pas de Calais	660,426	761,158
6. Picardy		15. Somme	615,983	557,015
		16. Seine-Inférieure	603,463	790,022
		17. Eure	591,261	377,874
7. Normandy	Rouen	18. Calvados	551,766	454,012
		19. La Manche	577,178	544,776
		20. Orne	610,068	398,250
		21. Finisterre	667,668	642,963
		22. Morbihan	681,704	490,352
8. Brittany	Rennes	23. Côtes-du-Nord	744,073	622,295
		24. Ille-et-Vilaine	672,848	589,532
		25. Loire-Inférieure	687,441	602,206
		26. Vendée	671,628	401,446
9. Poitou	Nantes	27. Sèrves (Deux)	559,995	331,243
		28. Vienne	697,301	320,598
10. Anjou	Angers	29. Maine-et-Loire	712,563	518,471
11. Maine	Le Mans	30. Mayenne	516,200	350,637
		31. Sarthe	620,397	446,603
12. Angoumois, Aunis, and St. Ange	La Rochelle	32. Charente	588,803	367,520
		33. Charente-Inférieure	716,814	465,653
13. Touraine	Tours	34. Indre-et-Loire	611,369	317,027
		35. Loir-et-Cher	635,092	268,801
14. Orléannais	Orleans	36. Eure-et-Loir	586,921	282,622
		37. Loiret	676,512	353,021
15. Nivernais	Nevers	38. Nièvre	686,619	339,917
16. Bourbonnais	Moulins	39. Allier	742,272	390,812
17. Marche	Guéret	40. Creuse	579,455	274,663
18. Berry	Bourges	41. Cher	740,125	335,392
		42. Indre	701,661	277,693
19. Limousin	Limoges	43. Vienne (Haute)	551,733	322,447
		44. Corrèze	586,621	302,746
20. Auvergne	Clermont	45. Cantal	574,146	231,867
		46. Puy-de-Dôme	800,679	566,463
21. Lyonnais	Lyon	47. Loire	477,018	550,611
		48. Rhône	281,356	670,247
		49. Ain	584,822	363,290
		50. Saône-et-Loire	855,018	598,344
22. Burgundy	Dijon	51. Côte-d'Or	876,956	374,510
		52. Yonne	736,916	363,608
		53. Saône (Haute)	531,000	303,088
23. Franche Comté	Besançon	54. Jura	503,264	287,634
		55. Doubs	522,895	291,251
24. Alsace	Belfort	56. Rhin (Belfort Dist.)*	250,000	56,781
		57. Isère	841,230	575,784
25. Dauphiné	Grenoble	58. Drôme	653,557	320,417
		59. Alpes (Hautes)	558,418	118,898
		60. Ardèche	551,227	380,277
		61. Loire (Haute)	495,784	308,732
		62. Lozère	516,666	135,190
26. Languedoc	Montpellier	63. Gard	582,867	420,131
	Toulouse	64. Hérault	630,985	429,878
		65. Tarn	576,821	352,718
		66. Garonne (Haute)	629,601	479,362
		67. Aude	631,667	285,927
		68. Aveyron	882,171	402,474
		69. Lot	398,406	281,404
		70. Dordogne	915,000	480,141
27. Guienne	Bordeaux	71. Tarn-et-Garonne	371,764	221,610
		72. Lot-et-Garonne	534,628	319,289
		73. Gironde	1,082,552	705,149
		74. Les Landes	985,273	300,528
28. Gascony	Périgueux	75. Gers	627,870	284,717
		76. Pyrénées (Hautes)	464,531	235,156
29. Bearn and Navarre	Pau	77. Pyrénées (Basses)	752,513	426,700
30. Foix	Foix	78. Ariège	478,401	246,298
31. Roussillon	Perpignan	79. Pyrénées (Oriental.)	411,376	191,856
32. Avignon, Venaissin, and Orange	Avignon	80. Vaucluse	359,640	263,451
		81. Rhône (Bouches-du-)	601,960	554,911
33. Provence	Marseille	82. Alpes (Basses)	690,919	139,332
		83. Var	729,628	293,757
34. Corsica	Bastia	84. Corse	994,741	258,507
35. Savoy	Chambery	85. Savoie	642,074	267,958
		86. Savoie (Haute)	451,488	273,027
36. Nice	Nice	87. Alpes Maritimes	429,874	199,037

* From 1871 until 1878, the portion of the department of Haut-Rhin remaining to France was called *Territoire de Belfort*. Subsequently the old name *Haut-Rhin* has been officially resumed.

divided in the proportion of about 600 kilom. on the Mediterranean, 950 kilom. on the Atlantic, and about 940 kilom. on the northern frontiers. The superficial area of F., including the two Savoy provinces, and Corsica, a department of the republic, but excluding the departments of the Bas-Rhin and the other territories lost to F. by the treaty of peace concluded with Germany in 1871, is reckoned at about 204,000 sq. miles. The possessions of F. which are situated in non-European parts of the world, have a total superficial area of 240,000 sq. miles. Algeria, with its 122,500 sq.m., is here included; but in French official statistics, Algeria is ranked separately from the other colonies as a more immediate dependency. F. is divided into 87 departments, most of which have been named from the rivers or mountains by which they are intersected. The foregoing table gives the names of the ancient provinces of F., with the corresponding departments, their chief towns, areas in hectares, and the population for 1872. The pop. of F., exclusive of Algeria and the colonies, was found by the census of 1876 to amount to 36,905,788.

By the treaties with Germany of Feb. and May, 1871, F. lost 1,447,466 hectares of land, and 1,597,228 inhabitants, comprised within 1689 communes, and distributed over five departments. These losses included the whole of the old department of the Bas-Rhin, two arrondissements with a fraction of the third (Belfort) of the department of the Haut-Rhin, the greater portion of the department of the Moselle, together with a number of cantons and communes in the department of the Meurthe and Vosges. The portions of the two departments of the Meurthe and Moselle remaining to F. have been incorporated into one.

Chief Cities.—The following table gives the populations of some of the largest cities of F. in 1872:

Paris, the capital	1,800,000
Lyons	323,000
Marseilles	300,000
Bordeaux	194,000
Lille	154,000
Toulouse	129,000
Nantes	111,000
Rouen	100,000

The provinces of Savoy and Nice were ceded to F. by Sardinia, in accordance with a treaty between the two governments, signed in 1861. The following table gives the non-European dependencies of France:

	Area in Hectares	Population in 1872.
In Africa—		
Algeria	39,000,000	3,000,000
Senegal and its dependencies	undefined	200,000
Ile de Réunion and Ste. Marie	250,000	170,000
Nossi-Bé and Mayotte	50,000	45,000
In Asia—		
East Indian possessions	50,000	170,000
Cochin China	2,200,000	1,000,000
In America—		
Martinique	98,000	125,000
Guadeloupe and its dependencies	165,000	151,000
Guiana	1,000,000	25,000
St. Pierre and Miquelon	20,000	3,000
In Oceania—		
Marquesas and other islands	117,000	10,000
New Caledonia	900,000	30,000

The total superficial area of the French colonies, including Algeria, and reckoning the districts under French protection, is estimated, as has been said, at 240 sq.m., and the population at about 6 millions; but of the latter number the great majority are natives and savages, or belong to only half-civilized races. The methods employed in taking the census are, moreover, so different in the different colonies, that the results are not entirely beyond question; while the limits of French protectorate authority have been very considerably diminished of late years in the eastern hemisphere, and in Africa also, if we except Algeria.

Population.—The population of F. has not exhibited the same rate of increase as other first-class European powers during the present century, for while the population of Great Britain has nearly doubled within the last fifty years, that of F. scarcely shows an increase of 40 per cent for the same period. In 1875, the birth-rate was only 2.64 per 100 inhabitants, a rate lower than in any other European country.

The following table shows the condition of the population from the beginning of the century to the date of the latest census:

Year of Census.	Number of Population.	Annual Increase.
1801	27,349,003	149,941
1806	29,107,425	351,685
1821	30,461,875	90,292
1826	31,858,937	279,415
1831	32,569,223	171,787
1836	33,540,901	194,337
1841	34,217,719	135,362
1846	35,400,486	236,553
1851	35,783,170	76,537
1856	36,039,364	51,236
1861	37,382,225	268,572
1866	38,067,094	136,186
1872	36,102,921	......
1876	36,905,788	128,310

The decline of population between the census of May, 1866, and of May, 1872, is 1,964,273, of which 1,597,228 is due to the loss of the different territories annexed to the German empire. The remainder is due partly to losses in the war, and partly to an absolute decrease in the population of 73 departments. Between 1872 and 1876, there was a decrease in 20 departments, most of all in Seine-et-Oise.

Coast, Islands, and Frontier.—The n.n.w. coast is generally irregular, indented with numerous bays, the principal of which is the bay of St. Malo, the archipelago of Bréhat, etc. The w.s.w. coast is more lofty and precipitous, and is interspersed with isolated rocks and promontories; while s. of the Loire it is low, and lined with salt marshes to the foot of the Pyrenees, where it again assumes a rocky character. Here lie the islands of Ushant (Ouessant), Belleisle, Noirmoutier, Isle d'Yeu, Ré, Oléron, etc. The coast of the Mediterranean, which is broken by lagoons or shore-lakes, is low till it has passed Toulon, after which it becomes bolder. The only islands off the shore are the Hyères, near Toulon; the larger island of Corsica (q.v.) lies n. of Sardinia. The Mediterranean here forms two bays or gulfs, as the gulf of Lyons and the gulf of Genoa, which belongs only in part to France. The land frontiers of F. are formed on the side of Spain by the Pyrenees; on that of Italy and Switzerland, by the Alps and Jura chain; on the n.e., the frontier line is unprotected by natural boundaries, and since the loss of Alsace and Lorraine is no longer defended, as before the war of 1870–71, by strong fortresses.

Plains, Mountains, and Rivers.—The chief plains are those of Burgundy, and of the oceanic district, embracing the lower basins of the Seine, Loire, and Garonne. F. has four great mountain chains—the Pyrenees (q.v.), which separate the French territory from Spain; the Cevenno-Vosgian range, formed of the Cevennes (q.v.), running e. and w. between the Rhone and Loire, and the Vosges, running n. and s. between the Moselle and the new boundary line; the Alps (q.v.), which separate the Swiss territory from the provinces of Savoy and Nice; and the Sardo-Corsican range, which belongs, as the name implies, to the islands of Sardinia and Corsica. The highest peaks in the Pyrenees are the Maladetta and mont Perdu (10,886 ft. and 10,994 ft.); in the Cevenno-Vosgian range, the greatest height (the Widderkalm) does not greatly exceed 7,000 feet. The French portion of the Alps now includes several of the highest mountains and most elevated passes of the range, as mont Blanc, 15,744 ft.; mont Iseran, 13,272 ft.; mont Cenis, 11,457 ft.; and the pass of Little St. Bernard, 7,190 ft., etc. In Corsica, the highest peak rises to an elevation of 9,000 feet. The grand water-shed of F. is the Cevenno-Vosges chain, which determines the direction of the four great rivers, the Seine, the Loire, the Garonne, and the Rhone; the first three of which flow n.w. into the bay of Biscay or the English channel, and the fourth into the gulf of Lyons. Besides these, the more important streams are the Moselle, Meuse, and Scheldt or Escaut (all of which soon leave France, and flow into the Netherlands, or Germany); the Somme and Orne (belonging to the basin of the Seine); the Vilaine and the Charente (belonging to the basin of the Loire); the Oise, the Aube, the Yonne, and the Marne, which are the chief affluents of the Seine; the Sarthe, the Loiret, the Allier, and the Maine, of the Loire; the Dordogne, the Lot, the Tarn, and the Adour, of the Garonne; and the Saône, the Isere, and the Durance, of the Rhone.

The entire extent of river navigation in F. amounts to 5,500 miles, or 8,900,000 mètres, while the 99 larger canals, which have been constructed either to connect these river courses or to supply entirely new channels of water-communication, extend over a length of 2,900 miles, or 4,700,000 mètres. The most important of these works are the canals connecting Nantes, and Brest, and the Rhone with the Rhine, and those of Berry, Nivernais, and Bourgogne. F. possesses only one lake of any importance, Le Grand-Lieu, a little to the s. of Nantes, which has an area of about 14,300 acres; but the country abounds in salt marshes or ponds, more especially in the districts of Gascony, Roussillon, and Languedoc.

F. is peculiarly rich in mineral springs, of which there are said to be nearly 1000 in use. Of these, more than 400 are situated in the group of the Pyrenees, where there are 93 establishments for their systematic use. It is estimated that there are, moreover, fully 4,000 springs not hitherto employed.

Geology, etc.—F. presents a great variety of geological formations, but although we meet with an almost complete succession of all the stratified and non-stratified formations, they are distributed with great inequality. Thus, for instance, while nearly one third of the soil is composed of tertiary formations, a mere fractional part only is made up of coal-beds. A belt of primary rocks, forming the skeleton of some portions of the Vosges, Alps, and Pyrenees, and of the great plateaus of Brittany and La Vendée, encircles the great central basin in which rises the volcanic formation of the mountains of Auvergne, with their extinct craters, lava-streams, etc. The spaces between this external breast-work and its volcanic nucleus is occupied by secondary and tertiary formations. Alluvial deposits are met with in all the valleys, but they occur in extensive beds only in the neighborhood of Dunkirk and Niort, and on the borders of the Mediterranean. According to M. Maurice Block's estimate, the physical and agricultural character of the soil of F. may be comprised under the following heads:

	Hectares.
Mountainous districts, heaths, and commons	9,944.839
Rich land	7,276,369
Chalk or lime districts	9,788,197
Gravel, stony, and sandy	15,951,618
Clay, marshy, miscellaneous	9,807,577
	52,768,600

The same writer further subdivides the soil of F. according to its actual employment under the following heads:

	Per cent of the whole area.
Arable lands	48.3
Meadow lands	9.7
Vineyards	3.7
Cultivated lands	17.8
Roads, streets, public walks, etc	3.7
Forests and unproductive lands	16.8

Climate.—F. possesses one of the finest climates in Europe, although, owing to its great extent of area, very considerable diversities of temperature are to be met with; thus, for instance, the n.e. parts of the country have a continental, and the n.w. parts an oceanic climate, resembling those of Germany and Great Britain; while the Mediterranean districts are exposed at times to the ravages of the burning winds which have passed over the deserts of Africa, and to the destructive n.w. wind known as the *mistral*, which often does great injury to the fields near the mouths of the Rhone and Var. The mean annual temperature of different parts of F. has been estimated as follows by Humboldt: Toulon, 62° F.; Marseilles, 59.5°; Bordeaux, 56°; Nantes, 55.2°; Paris, 51.2°; Dunkirk, 50.5°.

Products.—Of the vegetable products of F., which, from varied climatic and geognostic relations, are necessarily characterized by great abundance and diversity, the most generally cultivated are the cereals, the vine, chestnuts, olives, culinary fruits and vegetables, hops, beet-root for the manufacture of sugar, tobacco, madder, chicory, flax, etc. In 1862, the yield of wheat in F. was 116 millions of hectoliters, the maximum annual quantity as yet on record. During the last 50 years, the importation of cereals has so far exceeded the supplies for home consumption and exportation, as to leave F. the loser by 850 millions of francs. The cultivation of wheat has gradually increased during the last 50 years, but that of rye, barley, and maize has exhibited little variation; while the growth of potatoes has been most extensively augmented during the same period. The following table shows the fluctuations to which these alimentary substances have been subjected:

	EXTENT OF LAND OCCUPIED IN 1815, 1830, 1845, AND 1869.				QUANTITY YIELDED IN 1815, 1830, 1845 AND 1869.			
	1815. Hectares.	1830. Hectares.	1845. Hectares.	1869. Hectares.	1815. Hectoliters.	1830. Hectoliters.	1845. Hectoliters.	1869. Hectoliters.
By Wheat	4,591,677	5,011,704	5,743,135	6,900,000	39,460,971	52,782,098	71,963,280	108,000,000
" Rye	2,500,000	2,500,000	2,500,000	2,100,000	25,700,000	32,440,000	30,000,000	24,000,000
" Barley and Oats	1,100,000	1,100,000	1,200,000	1,400,000	14,600,000	17,600,000	18,400,000	90,000,000
" Maize	514,513	593,000	730,000	600,000	5,630,000	6,600,000	8,000,000	10,000,000
" Potatoes	600,000	800,000	925,000	100,000	21,600,000	54,835,167	77,900,000	100,000,000

The mean annual yields of these productions may be estimated as follows: Wheat, 73,000,000 hectoliters; rye, 22,000,000 hectoliters; barley and oats, 40,000,000 hectoliters; maize, 9,100,000 hectoliters; potatoes, 95,000,000 hectoliters.* The subdivision of

* The hectoliter equals 2.75 bushels.

farms, the short leases (of less than 10 years) on which the majority are let, and the small number of the great land-owners who reside on their estates, have hitherto tended to check the progress of agriculture in France. Agricultural exhibitions have been held since 1850; 360,000 francs are annually given in prizes, etc.; and there are now nearly 1000 agricultural associations in different parts of France.

The manufacture of sugar from beet-root, which took its origin during the great wars of the early part of the century, has been prosecuted with much vigor during the last 50 years, and about 150 millions of kilograms* are annually manufactured. Since the appearance of the vine-disease, beet-root has been extensively employed in the manufacture of alcohol. In 1873, there were 415,204,000 kilograms of beet-root sugar produced. The cultivation is almost limited to the north and east; hemp and flax are grown chiefly in the northern, but also in the south-western departments. The entire production of hemp was estimated in 1842 at 67,507,076 kilograms, worth 86,287,300 francs; and that of flax at 36,875,400 kilograms, worth 57,507,400 francs. Since that period, there has been little difference in the home production, but an enormous increase in the importation of foreign flax and hemp; the value of the hemp (not to speak of jute) imported in 1873 amounting to 16 millions of francs, and of the flax, 76,700,000 francs. The cultivation of the mulberry-tree derives importance from its bearing on the production of silk. In 1858, the department du Gard had monopolized nearly half the culture of these trees, which in its aggregate amount has continued unchanged. From its connection with the mulberry, we here refer to the production of silk, which began at the opening of the 17th c., and which in 1790 had reached such vast dimensions, that the produce at that period was already 6½ million kilograms of cocoons, worth 16½ million francs. Since that period, it has exhibited great variations. From 1840 to 1853, the production continued steadily to increase from 17 to 26 millions of kilograms; but the diseases to which the silk-worm has been liable since that period reduced the yield of silk to so great an extent, that in 1857 it scarcely amounted to 7 millions of cocoons. Raw silk, since the abatement of this disease, has again assumed its place among the chief sources of industrial wealth in F.; and, besides the enormous quantity consumed in home manufactures, the total exports for the year 1873 amounted to no less a value than 100 millions of francs.

The vine has, from a very early period, constituted one of the principal sources of the agricultural wealth of France. The choicest wines are grown in the Bordelais, Burgundy, and Champagne, but some excellent kinds are produced on the banks of the Loire, and in some of the southern departments. The breadth of soil devoted to this culture fluctuates, but may be stated at about 2,000,000 hectares. The mean produce for every hectare was, in 1788, 21 hectoliters 21 liters; in 1829, 27 hectoliters 20 liters; in 1850, 32 hectoliters 35 liters. Some time ago, the fungus known as the oïdium attacked the vine, and inflicted such serious damage on the plant, that in 1854 (the worst year), the hectare yielded 5 hectoliters, instead of the average quantity of 23 hectoliters. A new and very destructive vine-disease, occasioned by the ravages of an insect which has been called the *phylloxera vastatrix*, appeared in the s.e. of F. in 1865, and by 1873 had established itself in 12 departments. The following table shows some of the annual yields of wine between 1808 and 1874:

	Hectoliters.		Hectoliters.
1808	28,000,000	1854	10,789,869
1829	30,973,000	1858	45,805,000
1848	51,622,150	1874	63,146,125

The average yearly produce of the vineyards of F. is estimated at about 50 millions of hectoliters (about 1000 millions of gallons). Of this, about ⅕th is made into brandy. F. consumes nearly all the wine raised on her soil; the annual exports being on an average little more than 2 millions of hectoliters, valued at about 218 millions of francs.

The principal forest-trees are the chestnut and beech on the central mountains, the oak and cork tree in the Pyrenees, and the fir in the Landes. The destruction of the national forests has been enormous within the last two centuries, but measures have been taken in recent years to plant wood, in order to protect those mountain slopes which are exposed to inundations from Alpine torrents, and to provide a supply for the ever-increasing demand of wood for fuel. About one-seventh of the entire territory of F. is still covered with wood. Turf taken from the marshy lands is extensively used, more especially in the rural districts, for fuel.

Animals.—F. is not so well stocked with domestic animals as her great resources might warrant us in assuming that she ought to be. During the 50 years intervening from 1812 to 1862, the numbers of horned cattle were almost doubled in France. In 1872, according to the census report for that year, there were in F., in round numbers, 2,880,000 horses, 500,000 asses, 300,000 mules, 11,000,000 horned cattle, 25,000,000 sheep, 5,000,000 swine, and 2,250,000 dogs. There were in the same year about 2,390,000 hives of bees, valued at about 20 millions of francs; the mean annual returns are, for honey, 6,670,000 kilograms, and for wax, 1,620,000 kilograms. Poultry constitutes an important item of farm-produce in F., estimated at 45¼ millions of francs; while the

* The kilogram equals 2.2 lbs. avoirdupois.

eggs and feathers yield 35½ millions of francs: the number of fowls in 1872 was 58,000,000. The wild animals are fast diminishing from the soil of F.; the lynx is rarely seen, even among the higher alpine regions but wolves are still numerous in the mountainous districts of the central departments; while the chamois and wild-goat, as well as the marmot, ermine, and hamster, are found among the Pyrenees, Alps, and Vosges. The wild-boar, roebuck, fox, squirrel, polecat, and marten are to be met with in the woods. The red and fallow deer are scarce; hares and rabbits abound, and game generally is plentiful. The wanton destruction of small (singing) birds having been found to be conducive to the excessive increase of noxious insects, stringent municipal enactments are now being put into force for the protection of those birds.

Fisheries.—The French government expends between three and four millions of francs annually in aiding those engaged in the great fisheries. The value of the exports of fish from F. (12 millions of francs) is little more than half the value of the imports. There are no official reports of river and other fresh-water fishing in F., or of the minor fisheries carried on along the coasts, which constitute the principal means of occupation and support of the majority of the local population. Pilchards and mackerel are caught in large quantities off Normandy and Brittany. The w. coasts have extensive oyster and muscle beds; tunnies and anchovies are caught on the shores of the Mediterranean. The following table shows the condition of the principal branches of the fishing-trade in 1870:

	Numbers of men employed.	Ships.	Quantities in Metric Quintals.
Cod fisheries	13,189	661	359,046*
Herring fisneries	9,709	681	244,645

Mineral Products.—The chief mineral products of F. are coal and iron, in the excavation of which nearly 250,000 men were employed in 1868. Although F. is not rich in coal, it possesses several very considerable coal-beds, which are situated principally in the e.s.e. and north. The supply hitherto has not equaled the demand; although in 1874—the latest period determined—it rose to the enormous amount of 170 millions of quintals. Notwithstanding this home supply, it was found necessary to import many millions of quintals to meet the increased annual demand, which, before the late war, had risen above 200 millions of quintals, while in 1852 it was still under 120 millions. The iron mines of F. are of excellent quality, but their distance from the fuel necessary for the working of the mineral, renders them of relatively small value. In 1874, there were 150 mines in operation, from which 40 millions of quintals were taken; more than half of this quantity being obtained from the five departments of Haute-Marne, Haute-Saône, Cher, Moselle, and Nord. F. imports iron from Switzerland, Germany, Belgium, and England. Argentiferous galena, a little silver and gold, copper, lead, manganese, antimony, and tin occur, but hitherto their working has not proved very productive. The department of Charente-Inférieure yields the largest amount of salt, the mean annual produce being 1¼ million of quintals (2¼ millions of francs), which is fully one third of the entire annual produce of the whole country. F. derives about 41 millions of francs from its quarries of granite and freestone, its kaolin, marbles, sands, lithographic stones, millstones, etc. Granite and syenite are found in the Alps, Vosges, Corsica, Normandy, and Burgundy; porphyry in the Vosges, and basalt and lava for pavements in the mountains of Auvergne. Marble is met with in more than 40 departments; alabaster occurs in the Pyrenees; the largest slate-quarries are situated near Cherbourg and St. Lô.

The following list gives an approximative estimate of the value of the chief products of French industry:

	Millions of Francs.
Linen fabrics	250
Cotton "	650
Woolen "	950
Silk "	1,000
Mixed "	330
Jewelry, watchmaking	35
Gilt-wares	12
Minerals, mines, salt, etc	600
Articles of food—as sugar, wines, etc	364
Skins, leather, oils, tobacco	556
Bone, ivory, isinglass, etc	30
Chemical products	80
Ceramic arts	86
Paper, printing	60
Forests, fisheries	98

Industry, Trade.—The principal seats of industry are as follows: For textile fabrics, the department Le Nord, La Sarthe, Maine-et-Loire, Seine-Inférieure, Le Calvados, Seine-et-Oise, Ille-et-Vilaine, etc. F. stands unrivaled for her silk manufactories, the

* The quintal equals 1.97 cwt.

finest of which are at Lyons, Tours, and Paris; while St. Etienne is the special seat of the ribbon trade. Alençon, Bailleul (fabricating the so-called *Valencienne*), Lille, Arras, Caen, and Bayeux are all famous for their laces and blonds, which alone occupy 250,000 persons. Rheims stands conspicuous for its *merinos* and fine flannels; Amiens and Nancy for their fine printed woolen goods; Lodève and Elbœuf for army cloths. Gloves are made at Grenoble, Paris, etc. The best carpets are made at Aubusson, Abbeville, and Amiens. Paris is the seat of industry for some of the most costly fabrics, as Gobelins tapestry, shawls of great value, watches, clocks, articles of *vertu*, carriages, philosophical instruments, etc. Sèvres stands unrivaled for its china and glass. St. Gobain and St. Quirin manufacture looking-glasses of the largest size.

The trade of F. is inferior only to that of England and the United States. The great emporiums of trade are Paris, Lyon, St. Etienne, Lille, Rheims, Nîmes, Toulouse, St. Quentin, Orleans, Avignon, Montpellier, etc.; and the most active maritime ports are Marseilles, Cette, Havre, Bordeaux, Nantes, Rouen, Calais, Dunkirk, Boulogne, Dieppe, etc. These centers of trade have all suffered at different periods during the present century, from the political disturbances under successive governments; but notwithstanding these drawbacks, the commercial activity of the country had made rapid strides within the last 80 years before the war of 1870–71. The following table shows the condition of trade during four years of the old monarchy:

Years.	Value of Imports in millions of francs.	Value of Exports in millions of francs.	Total.
1787	551	440	991
1788	517	466	983
1789	577	441	1,018
1792	929	803	1,732

While the rate of this progress during five years preceding 1875 has been as follows:

Years.	Imports in millions of francs	Exports in millions of francs.	Total.
1870	2,781	2,860	5,641
1871	3,393	2,685	6,078
1872	3,570	3,761	7,331
1873	3,554	3,787	7,341
1874	3,748	3,877	7,625

The transit trade of F. is effected by maritime navigation between foreign and French ports, by coasting traffic, or *cabotage*, between various French ports, and by railways. The merchant navy, which has increased extensively of late years, numbered, in 1877, exclusive of small fishing vessels—*bateaux de la pêche côtière*—15,407 vessels having a tonnage of 1,011,285; of these, 546 were steamers of 213,440 tons, and 71,750 horse-power. The *cabotage*, or internal and coasting traffic, is a great source of financial wealth to the state, to which all rivers and canals belong. There is a length of 13,155 kilometers available for inland navigation in F., but, according to official reports, three fourths of the entire traffic is concentrated upon 1800 kilometers of this distance. Of this number, 73 per cent belonged to the ocean ports, and 27 per cent to the Mediterranean.

Railways, etc.—According to the official report, the railways in operation in the year 1877 measure 22,671 kilomètres, or 14,200 miles. With the exception of less than 200 m., the railways of F. are held by six companies, which are under the superintendence of the state, from which they receive the following subsidies as defined by the budget for 1873:

	Francs.
Eastern line	57,900,000
Western line	82,000,000
Orleans line	92,416,000
Lyons	189,233,333
South	45,300,000
North	45,300,000

The total receipts of all the lines were, for 1858, 334,769,469 francs; and the total number of passengers conveyed by rail, 37,952,398. In 1865, the number was 81,533,061; and in 1869, 111,164,284. In 1877, the total receipts were 842,199,600 francs. By a clause in the treaty of 1871, the whole of the lines of the Eastern company in Alsace-Lorraine, about 700 kilomètres in length, were sold to the imperial government of Germany for 325 millions of francs.

The creation of the first high-roads in F. is referred to Philippe Auguste; and their more perfect organization in the 16th and 17th centuries, to Henry IV. and Louis XIV. Under Napoleon I. there were 125 high-roads, extending in all over 30,000 kilomètres; and at the present time there are upwards of 600 national roads (35,000 kilom.), 265,000 departmental roads (45,000 kilom.).

Postal Service.—The postal service in F. goes back to the year 1464, when Louis XI. placed it under the direction of the state. Since 1848, a system of low prepayment for letters has been established. At the present time, letters weighing from under 10 to under 100 grammes require stamps from 15 centimes to 1 franc 20 centimes, according to weight. The whole receipt of the postal service was for the year 1874, 110,416,000 francs; while, for 1869, before the war, it was 94,199,359 francs; the expenses in the mean while have risen from 63 million francs in 1869, to nearly 72 millions of francs in 1874.

Electric Telegraph.—The first electric telegraph was constructed in F. in 1844, and F. is now intersected by a close net-work of wires, which flash communications between Paris, as the central focus, and every part of the empire. At the beginning of 1878, there were 35,445 m. of lines, comprising 89,522 m. of wire. The number of telegraphic messages sent in 1877 was 8,518,013, of which 1,037,730 were international.

Constitution, Government.—On Sept. 4, 1870, the emperor, Napoleon III., was declared to be no longer the head of the state, and France was proclaimed a republic. At the close of 1872, the supreme power was vested in a national assembly, with whom rests the nomination of the chief officer of the state, bearing the title of "president of the French republic;" and nominated for seven years. This officer, as chief of the executive power, but under responsibility to the national assembly, is authorized to promulgate and insure the proper execution of all laws and ordinances transmitted to him by the president of the assembly. By the law of Feb. 25, 1875, the national assembly is to consist of two bodies—the chamber of deputies and the senate. The members of the former are elected by universal suffrage; the senate consists of 300 members, of whom 225 are elected by the departments and colonies, and 75 by the national assembly. The budget for 1876 was charged 8,557,000 francs for the administrative expenses of the national assembly and the authorized indemnities of the deputies. To the president of the republic belongs, in accordance with the principles that have regulated the respective domains of legislative and executive power in F. under all forms of government, the right of appointing the judges, commanding the forces, and maintaining relations and settling treaties with foreign states, in respect to which acts he is responsible to the assembly. He appoints and dismisses the ministers of state, who are also responsible to the assembly, and he may reside at the seat of the national assembly, and, provided he gives notice of his intentions, may take part in its deliberations. His salary was fixed in 1873 at 600,000 francs (£25,000), with an extra allowance of 162,000 francs for household expenses. The office of president was held till 1873 by M. Thiers; from 1873 till 1879, by marshal MacMahon; and thereafter by M. Grévy.

The ministry is presided over by nine ministers of state, each of whom has a definitely limited sphere of administrative duty and authority; and in addition, the president is assisted in the government by a council of state, "conseil d'état," which, according to a decree of the national assembly, is to consist in all of 43 members, 15 of whom may be nominated by the president, while the remaining 28 are selected by the assembly. The functions of this body are restricted to giving advice on bills presented to the national assembly by the president or the ministers.

Departments, etc.—F. is at present divided into 86 *departments*, comprising 362 *arrondissements*, 2,865 *cantons*, and 35,985 *communes*. Each department is presided over by a préfet, nominated by the president of the republic on the presentation of the minister of the interior; each arrondissement by a sub-préfet; each canton by a member of the general council of the département, which meets annually for whatever period may be decreed by the head of the state; and every commune has its *maire* and municipal council. Every chief town of a canton has its commissary of police; in the larger towns, there must be one of these officers to every 10,000 inhabitants. The administration of justice is presided over by a special minister of state, who is keeper of the seals. A supreme tribunal serves as a court of appeal from the lower courts. The tribunals of commerce and police, together with those of the several departments, take cognizance of the various civil and criminal cases specially falling within their several spheres. There are 357 tribunals of the arrondissements, or *tribunaux de première instance*, which are divided into six classes; 2,681 police courts; 216 tribunals of commerce; 26 courts of appeal, divided into four classes; a *cour de cassation*, divided into three chambers, which confirms or annuls the sentences of the police and assize courts; and a *haute cour de justice*, which gives final judgment in all cases of offense against the state. Assizes are held every three months in 59 towns; and, independently of the ordinary judicial magistrates, the courts of assize are composed of juries of twelve men, chosen in accordance with certain prescribed regulations. In the maritime and commercial towns there were, under the empire, 85 councils of *prud'hommes* (experienced men), with summary jurisdiction in matters to the amount of 200 francs. These councils, which are composed of master-workmen elected annually, decide on causes of dispute, chiefly in regard to questions of wages, and differences between masters and men. The state is charged 33¼ millions of francs annually for the expenses incident to the ministry of justice, according to the budget for 1876. There are 387 departmental prisons, 21 central houses of detention, 2 political prisons at Doullens and Belleisle, and numerous penitentiaries and reformatories for the young. All these prisons, excepting the two for political offenders, are in part self-supporting. The

only hulks, *bagnes*, still remaining, are at Toulon, where convicts of a certain class undergo their sentences, but the principal penal settlement is in French Guiana (q.v.).

Religion, Churches.—No person can be molested in F. on account of his religious opinions, provided the manifestation of them does not disturb the public peace as established by law. The public exercise of any special form of religion must, however, be preceded by the official authorization of the préfet, or in special cases, by higher authority. The *recognized* forms of faith are—the Roman Catholic, the Protestant, (including the Reformed and Lutheran), the Jewish, and, for Algeria, the Mohammedan. The clergy attached to these religions receive their pay from the state, and are exempt from military service. The Roman Catholic church embraces the great majority of the people. Of the 36,000,000 which constitute the present population of F., 1,500,000 appertain to the two Protestant churches, 150,000 to the Jewish persuasion; and 25,000 to non-recognized but tolerated denominations, the Anabaptists comprising nearly one third of this number.

At the breaking out of the revolution, the annual revenues of the church amounted to 150,000,000 of livres, and its debts to 133,000,000. The state appropriated to itself the funds of the church in 1789, and assumed the responsibility of maintaining public worship. The following table gives a summary of the expenses incurred by the state for the maintenance of religion since the consulate:

Years.	Catholic Religion.	Protestant Church.	Jewish form of Faith.	Moham. Rel. in Algeria.
	Francs.	Francs.	Francs.	Francs.
1808	4,059,006	22,363		
1818	16,628,868	695,000		
1828	26,188,445	577,829		
1835	33,523,319	849,763	79,995	3,000
1847	37,630,008	1,240,229	108,836	3,000
1854	42,223,329	1,828,891	149,428	568,024
1859	44,994,100	1,408,436	189,400	630,200
1873	51,500,000	1,400,000	278,000	500,000

The archbishops and bishops of the church of F. are to be nominated by the president of the republic, and canonically inducted by the pope. There are 88 Roman Catholic prelates—18 archbishops, and 70 bishops. The archbishop of Paris receives 50,000 francs per annum; the other archbishops, 20,000 francs; the bishops, 15,000 francs. Six French prelates hold the rank of cardinals, to which dignity they are nominated by the pope on the presentation of the president. Every archbishopric has 3, and every bishopric 2 vicars-general, the whole number being 190. Their salaries vary from 3,500 to 4,500 francs. There are 709 canons belonging to the various cathedral chapters, receiving from 1600 to 2,400 francs per annum; 3,437 curés or parochial beneficed clergy, who are canonically inducted by the bishops, under the approval of the state; and 31,586 curates or *desservants*. The curés receive from 1200 to 1500 francs; the curates. 200 francs. The curés may be assisted by a certain number of vicariats, who receive from 350 to 500 francs; there are at present 9,000 authorized by the state. There are in F. 105 Reformed consistories, and 44 belonging to the Lutheran church. The central council of the Reformed churches holds its sittings at Paris. Synods composed of the delegates of five churches may assemble with the authority of the state to regulate the celebration of the services of their church; but their meetings cannot last longer than six days, and their decisions must be submitted for the approbation of the government. There is a Protestant seminary for the Reformed at Montauban. Besides the sums inscribed in the budget for the maintenance of religion, the departments are charged with special annual subsidies, which have risen of late years in a rapid ratio, and amounted in 1868 to upwards of 717,000 francs.

Public Instruction.—Public instruction is presided over in F. by a special ministry. Nearly half the expenses connected with it are defrayed by the state, and the remainder by the departments. There are 15 academies located in the following towns—Aix, Besançon, Bordeaux, Caen, Clermont, Dijon, Douai, Grenoble, Lyons, Montpellier, Nancy, Paris, Poitiers, Rennes, Toulon. These academies are divided into the five faculties of theology, law, medicine, sciences, and literature, and supplemented by various superior and preparatory schools. The professors are paid partly by the state, and partly by fees. There are 81 normal schools intended to train teachers for the higher departments of instruction. Secondary instruction has received an immense impetus during the present century. In 1872, there were 41,800 free and public schools for boys, and 17,500 public schools for the use of girls, and the entire number of scholars exceeded four millions. In 1872, the number of people unable to read or write between the ages of 6 and 20 was 2,082,328; above 20, 7,702,362. The departments share very unequally in the diffusion of education, the census of 1872 showing a percentage of ignorance ranging from 6 to 60 in the 87 departments; and it may be observed that the proportion of the educated is highest in the n. and e. of France. F. supports numerous colleges and schools for instruction in special branches of knowledge: as l'ecole des chartes; des langues orientales; des beaux-arts, founded in 1671 by Louis

XIV.; de dessin, founded in 1766 by Louis XV.; the conservatoire de musique, founded in 1784; l'école de Rome, founded by Louis XIV., and l'école d'Athènes, founded in 1846; l'école des ponts et chaussées, for the instruction of engineers of public works; l'école des mines (1783); the conservatoire national des arts et métiers, for the application of science to the arts and trades; the central school des arts et métiers; and the national schools for arts and trades. There are numerous agricultural, forest, farming, and veterinary schools, besides the école polytechnique, specially designed to prepare youths for the public services; and military and naval colleges at St. Cyr, Saumur, Paris, Vincennes, Brest, Toulon, and St. Denis.

Literary and Scientific Institutions.—Among the literary and scientific institutions of F. the first is l'institut de France (q.v.). The museum of natural history, known formerly as the jardin du roi, is one of the finest in the world. The bureau des longitudes and the observatoire, at Paris and Marseilles, have occupied the first rank among scientific institutions since their foundation. These establishments are all maintained at the cost of the state. Paris possesses several libraries belonging to and supported by the state, but freely opened to the public. The most important of all is that now known as la bibliothèque nationale. See LIBRARIES. There are 338 public libraries in the provinces, to all of which access is afforded in the most liberal spirit. F. is rich in public galleries of painting, statuary, and articles of *vertu*. The expenses of secondary and primary education, literary and scientific institutions, national archives, etc., are charged in the bndget for 1876 at 38,220,000 francs.

Theaters.—The theater, like all other public institutions, is under the surveillance of the state, which charges the annual budget for the maintenance of theatrical companies; nearly 7 millions of francs being inscribed on the budget of 1876 for the support of theaters, the fine arts, etc.

Charitable Institutions.—F. is rich in institutions of charity, many of which are remnants of the old system of church relief; but the *crèches*, of which there are several hundreds, and which are, in fact, free nurseries, are a modern form of charity, which originated (in 1844) with M. Marbeau at Paris. The public hospitals and infirmaries are maintained by special endowments, a percentage on the receipts at theaters and other places of amusement, and by subsidies from the government and local communes. Public charities for the relief of paupers derive their resources either from departmental or municipal funds, and are administered by the *bureaux de beinfaisance*, by the *dépôts de mendicité*, and by numerous other local institutions; besides which, the state contributes between 8 and 9 millions of francs (for 1876, 8,485,810 francs) for charitable purposes.

Taxation, Finances.—The public revenues are obtained in F. from direct and indirect taxation, and comprised in the budget, voted by the national assembly, under the heads of ordinary resources and special resources; the former including direct and indirect taxes, from stamps, the produce of forests, telegraphs, Algeria, etc.; and the latter, departmental funds, special imposts, etc. The following table shows the financial report of the public receipts and expenditure for different years from 1815 to 1876:

Years.	Receipts, in francs.	Expenditure, in francs.
1815	743,830,200	798,590,859
1824	994,971,962	992,583,283
1830	1,031,796,054	1,095,142,115
1840	1,234,483,099	1,363,711,102
1850	1,431,622,471	1,472,587,238
1859	1,766,080,877	1,773,919,114
1871	2,190,120,590	2,161,262,952
1876	2,575,028,582	2,570,505,518

Public Debt.—In 1814, the date of the restoration, the interest of the debt was 63 million francs; under the Bourbons it rose to 200 millions; and from 1830 to 1848, Louis Philippe increased it to 244 millions. During the three years of the second republic, 5 millions were paid off; but the second empire (1852–69) added nearly 120 millions to the annual burden. The increase of the debt during the empire arose from a succession of loans raised by borrowing directly from the mass of small capitalists, without the intervention of large banking-houses. The amount of the national debt of F. is very variously given according to what is included under that head; but if we take the funded debt bearing *rentes* or interest, the amount of such *rentes* in Jan., 1870, before the war, is stated at 358 million francs = about £14,000,000, representing a capital of 11,500 million francs, or £460,000,000. The loans and other obligations incurred to meet the expenses of the war of 1870–71, including the indemnity of 5 milliards of francs to Germany, nearly doubled this sum. The total expenditure arising from the war and the foreign occupation has been finally stated at 9,820 millions of francs; yet in spite of this enormous strain on the exchequer, the national wealth of F. has increased since the war. In 1876, provision had to be made for paying, as annual interest of the total debt, over 1150 millions of francs. This was calculated to correspond to a capital sum of 23,408 millions (nearly 23¼ milliards) of francs.

The continual deficits from the close of the first empire in 1815 to the close of the second empire in 1870, have been covered by loans, bearing interest or *rentes* at the rate of 3, 4, 4½, and 5 per cent. The budgets voted annually by the representatives of the

nation have almost invariably shown a small assumed surplus; while the *compte définitif* for the corresponding period, when published some years afterwards, has without exception exhibited a large deficit. The actual state of accounts with regard to national income and expenditure is not published till after the lapse of six or seven years; so that in 1877 the most recent final account (*budget réglé*) was that for the year 1869. The following table shows the rate at which the deficits have increased since 1814:

Periods.	Amount of Deficits. Francs.
Bourbon Monarchy, from 1815 to 1830	22,550,000
Reign of Louis Philippe, from 1830 to 1848	997,866,000
Second Republic, from 1848 to 1852	859,374,000
Second Empire, from 1852 to end of 1869	2,138,539,500

The total value of the French money in circulation is 12,630,657,996 francs. According to the act of monetary union effected between F., Belgium, Switzerland, and Italy, the emission of coined pieces is to be at the rate of 6 francs for every inhabitant, which, taking into account the presumed increase of population to the year 1880, when the term of the treaty expires, gives for F. the sum of 239 millions; for Belgium 32, for Italy 141, and for Switzerland 17 millions of francs. The amount of specie in reserve in the bank in Jan., 1873, was 790,000,000 francs; the amount of notes in circulation by the bank and its branches was 2,858,619,270 francs. The maximum amount of notes in circulation has been fixed at 3,000,000,000 francs, by the decree of the national assembly of July, 1872.

Army.—Standing armies date in F. from the time of Charles VII. The law of 1832 regulated the sytem of recruiting by conscription, on the footing which, with few modifications, it has subsequently occupied. By the law of 1872, substitution and enlistment for money are prohibited, and the principle of universal liability to arms is laid down, in accordance with which every Frenchman must be for 5 years in the "active army," for 4 years in the reserve of the same, for 5 years in the territorial army, and for 6 years in the reserve of the territorial army. Besides the ordinary physical causes of exemption, there are various others admitted, arising from family, social, or individual conditions; while, moreover, young men who pass the necessary examination, may obtain exemption by enlisting as volunteers for one year only, and defraying the cost of their maintenance and clothing. The returns for 1871 gave the strength of the French army as follows: Peace-footing—404,192 men, 86,368 horses; war-footing—757,727 men, 143,238 horses; while the estimated cost was somewhat more than 430,000,000 francs. In 1878, the army of F. was estimated to consist of 502,697 men, including 281,601 infantry, 68,617 cavalry, 77,291 artillery and engineers, and 75,188 other troops. The presumed expenses in the budget were 538,266,499 francs. F. is divided into 18 military commands, or *corps d'armée*, each under a field-marshal, which are subdivided into districts commanded by generals of division, and into lesser circles, corresponding with the departments, and under generals of brigades. The fortified *chefs-lieux* are at Arras, Bayonne, Besançon, Bourges, Brest, Cherbourg, Grenoble, Langres, La Rochelle, Le Havre, Lille, Lyons, Marseilles, Montpellier, Nantes, Perpignan, St. Omer, Toulon, and Toulouse. Metz and Strasburg were formerly included in this number, but since their annexation by Germany, Avignon, Perpignan, Quiberon, and Rouen have been converted into military chefs-lieux in their place. The *garde nationale* (q.v.), formerly a supplement to the regular army, was created in 1789, and organized in 1791. But owing to the proved incompetence of the force during the communistic outbreak in 1871, it was decreed that it should gradually be abolished.

Navy.—In 1878, the French navy numbered 2 admirals, 15 vice-admirals, 30 rear-admirals, 100 captains of first-class men-of-war, 200 captains of frigates, 640 lieutenants, and 500 ensigns. The sailors afloat and on shore numbered 28,500, which, together with engineers, etc., brought the grand total of those employed in the fleet to about 65,000. The inscription for the navy owes its systematic organization to the great minister Colbert (1681). At present, all persons engaged in any maritime avocation between the ages of 18 and 50 are liable to inscription, but the service is only compulsory for 3 years. There are 170,000 names on the rolls. Of these, 130,000 may be called out in time of war. The fleet consisted in 1878 of 53 iron-clads, 264 unarmored screw-steamers, 62 paddle-steamers, and 113 sailing-vessels. Amongst these are included torpedo-boats and gun-boats. The iron-clads carry 450 guns. There are 22,400 marines in peace, 28,000 in war, and 25,500 customs and coast-guard men. F. has 6 dépôts for marine artillery, 3 foundries, and 2 manufactories for projectiles. There are special hospitals, schools, and libraries for the use of the navy; and 5 maritime districts, subdivided into 12 arrondissements, at which are administrative courts for the settlement of all naval questions.

Money, Weights, and Measures.—For the money, weights, and measures now used in F., see FRANC, METER, LITER, GRAMME.

Colonies.—Algeria (which, according to the constitution of 1852, is not a colony, but an integral part of F.) is treated of in a separate article. In the larger French colonies, the administrative power is vested in a governor, who exercises supreme military command, and is assisted by a general council, specially charged to vote the budget of the

province. Three officers act under the orders of the governor—viz., the "ordonnator," director of the interior, and procurator-general. There is also in each colony a colonial controller, who presides over the financial and other departments of general administration.

See *Statistique génér. méthodiq. et compl. de la France.* by J. H. Schnitzler; *Dictions. et Annuaires de l'Administ. Franc.; Bulletin des Lois* (1878); *Statistique de France* (1878); *Dictionnaire général de la Politique*, by M. Maurice Block (1873).

History.—Gallia (Eng. *Gaul*) was the ancient name under which F. was designated by the Romans, who knew little of the country till the time of Cæsar, when it was occupied by the three races of the Aquitani, Celtæ, and Belgæ, who respectively inhabited the s.w., the w. and central, and the n. and n.e. parts. There were also some tribes of Germans, Ligurians, and Greeks, but the latter never penetrated far beyond the shores of the Mediterranean, where they planted colonies, the most important of which was Massalia (Marseilles). Under Augustus, Gaul was divided into four provinces, which, under subsequent emperors, was dismembered, and subdivided into seventeen. In the decline of the Roman power, Gaul was ravaged by neighboring hordes, and in the 5th c. it fell completely under the power of the Visigoths, Burgundians, and Franks. In 486 A.D., Clovis, a chief of the Salian Franks, raised himself to supreme power in the north. His dynasty, known as the Merovingian, ended in the person of Childeric III., who was deposed, 752 A.D., after the kingly power had already passed into the hands of the former Maire du Palais, Pepin d'Heristal, and, after him, into those of Charles Martel and Pepin le Bref. The accession of Pepin gave new vigor to the monarchy, which, under his son and successor Charlemagne, crowned emperor of the west in 800 (768–814), rose to the rank of the most powerful empire of the west. Christianity, civilization, and letters were protected during his reign, and before his death he had stretched the limits of his empire from the Eider and the German ocean to the Ebro and the Mediterranean, and from the Atlantic to the Baltic. With him, however, this vast fabric of power crumbled to pieces, and his weak descendants completed the ruin of the Frankish empire by the dismemberment of its various parts among the younger branches of the Carlovingian family. Intestine wars desolated the land, and foreign assailants threatened it on every side. In 911 A.D., the ravages of the Northmen had assumed so persistent a character, that Charles le Simple was glad to purchase immunity from their encroachments by the cession of the territory subsequently known as Normandy. Anarchy reigned paramount; the various governors established an hereditary authority in their several governments, and the crown was by degrees deprived of the noblest part of its appanages. The power of some of the vassals surpassed that of the kings; and on the death of Louis V. the Carlovingian dynasty was replaced by that of Hugues, count of Paris, whose son, Hugues Capet, was elected king by the army, and consecrated at Rheims, 987 A.D. At this period, the greater part of F. was held by almost independent lords, and the authority of the Capetian kings extended little beyond Paris and Orleans. Louis le Gros (1108–37) was the first of the race who reinstated order. He promoted the establishment of the feudal system, abolished serfdom on his own estates, secured corporate rights to the cities under his jurisdiction, and gave efficiency to the central authority of the crown. A greater degree of general order was thus secured, while a new element in the state was generated by the foundation of a free burgher class. Louis carried on a war against Henry I. of England; and when the latter allied himself with the emperor Henry V. of Germany against F., he brought into the field an army of 200,000 men, whose ready appearance afforded the first instance of the existence of a common national feeling of patriotism, ready to respond to the appeal of the sovereign. The *oriflamme* is said to have been borne aloft for the first time on this occasion as the national standard. Louis VII. (*Le Jeune*), who took part in the second crusade (1137–80), was almost incessantly engaged in war with Henry II. of England. His son and successor, Philippe Auguste (1180–1223), recovered Normandy, Maine, Touraine, and Poitou from John of England, and increased the power of the crown in various other parts of France. He took an active personal share in the crusades, and permitted the pope to organize a cruel persecution against the Albigenses in the southern parts of the country. Philippe was the first to levy a tax for the maintenance of a standing army, and in his reign a chamber of peers, of six secular and six ecclesiastical members, was instituted, to act as a council of state. Many noble institutions date their origin from this reign, as the university of Paris, the Louvre, etc. By the amendment of the administration of justice, the right of appeal to the royal courts was established, and the arbitrary power of the great vassals crippled. Improvements in the mode of administering the law were continued under his son, Louis VIII. (1223–26), and his grandson, Louis IX. (1226–70), who caused a code of laws (*Etablissements de St. Louis*) to be promulgated. St. Louis also effected many modifications in the fiscal department, and, before his departure for the crusades, secured the rights of the Gallican church by a special statute, in order to counteract the constantly increasing assumptions of the papal power. Under his son, Philippe III. (1270–85), titles of nobility were first conferred by letters-patent. He added Valois and the *comtés* of Toulouse and Venaissin to the crown. Philippe IV. (1285–1314), surnamed *Le Bel*, acquired Navarre, Champagne, and Brie by marriage. With a view of securing support against the secular and ecclesiastical nobility, with whom he was constantly at war, Philippe gave prominence to

the burgher element in the nation, and on 28th Mar., 1302, he, for the first time, called together the *états généraux*, or general estates, at which the *tiers état*, or burgher class, appeared together with the nobles and clergy. These changes were, however, accompanied by arbitrary innovations in the fiscal and other departments of the government, which were effected with reckless haste and violence. With a view of securing to the crown the great fiefs, he abrogated the right of females to succeed to landed property. His tyrannical persecution of the Templars showed the extent to which the regal power could be stretched; and under his successors, Louis X. (1314–16), Philippe V. (1316–21), and Charles IV. (*Le Bel*), (1321–28), the last direct descendant of the Capetian line, the rule of the kings of F. became even more unlimited, whilst the court was given up to every species of luxurious indulgence known to the age. Philippe VI., the first of the house of Valois (1328–1350), a distant relative of Charles IV., and the nephew of Philippe IV., succeeded in right of the Salic law. His reign, and those of his successors, Jean (1350–64) and Charles V. (*Le Sage*), (1364–80), were disturbed by constant wars with Edward III. of England, who laid claim to the throne in right of his mother, a daughter of Philippe le Bel. The war began in 1339; in 1346, the battle of Crécy was fought; at the battle of Poitiers (1356), Jean was made captive; and before its final close after the death of Edward (1377), the state was reduced to bankruptcy, the nobility excited to rebellion, and the mass of the people sunk in barbarism. Falsification of the coinage, onerous taxation, and arbitrary conscriptions brought the country to the verge of irretrievable ruin, while the victories of England humbled the sovereign, annihilated the French armies, and cut down the flower of the nation. The long and weak minority of Richard II. diverted the English from the prosecution of their groundless claims to the kingdom of F., which revived somewhat from the effect of its long and disastrous warfare; but during the regency for the minor, Charles VI. (*Le Bien Aimé*), (1380–1422), the war was renewed with increased vigor on the part of the English nation, who were stimulated by the daring valor of Henry V. The signal victory won by the English at Azincourt in 1415; the treason and rebellion of the French princes of the blood, who governed the larger provinces; the ambition of the several regents, the ultimate imbecility of the king, the profligacy of his queen, and the love of pleasure early evinced by the dauphin; all combined to aid Henry in his attempts upon the throne. But the premature death of Henry, the persevering spirit of the people, and the extraordinary influence exercised over her countrymen by the maid of Orleans, concurred in bringing about a thorough reaction, and, after a period of murder, rapine, and anarchy, Charles VII. (*Le Victorieux*) (1422–61) was crowned at Rheims. He obtained from the estates general a regular tax (*taille*) for the maintenance of paid soldiers, to keep in check the mercenaries and marauders who pillaged the country. The policy of his successor, Louis XI. (1461–83), the first king entitled "his most Christian majesty," favored the burgher and trading classes at the expense of the nobles, while he humbled the power of the crown-princes. He was a crafty ruler, who managed the finances well, and succeeded, by policy and good luck, in recovering for the crown the territories of Maine, Anjou, and Provence; while he made himself master of some portions of the territories of Charles the bold, duke of Burgundy. Charles VIII. (1483–98), by his marriage with Anne of Brittany, secured that powerful state, and consolidated the increasing power of the crown. With him ended the direct male succession of the house of Valois. Louis XII. (1498–1515) (*La Père du Peuple*) was the only representative of the *Valois-Orleans* family. The tendency of his reign was to confirm the regal supremacy, while the general condition of the people was ameliorated. He and his successor, Francis I. (1515–47), of the *Valois-Angoulême* branch, wasted their resources in futile attempts to establish their hereditary claims to Lombardy, and were thus perpetually embroiled with the house of Austria. A *concordat* with the pope, signed in 1516, secured the nomination of the Gallican bishops to the king. In this reign, the assembly of notables and deputies superseded the general estates. The defeat of Francis at the battle of Pavia, in 1525, and his subsequent imprisonment at Madrid, threw the affairs of the nation into the greatest disorder, and embarrassed the public finances to a most ruinous extent. Arts and literature were encouraged in this reign, and in that of the succeeding monarch, Henri II. (1547–59), who continued the disastrous Italian war. In the latter reign began the persecutions of the Protestants, which were carried on with still greater cruelty under Henri's three sons, Francis II. (1559–60), Charles IX. (1560–74), and Henri III. (1574–89), the last of this branch of the *Valois*. The massacre of St. Bartholomew (1572) was perpetrated under the direction of the queen-mother, Catharine de' Medici, and the confederation of the league, at the head of which were the Guises. The wars of the league, which were carried on by the latter against the Bourbon branches of the princes of the blood-royal, involved the whole nation in their vortex. The succession of Henri IV. of Navarre (1589–1610), a Bourbon prince, descended from a younger son of St. Louis, allayed the fury of these religious wars, but his recantation of Protestantism in favor of Catholicism, disappointed his own party. The early part of his reign was perpetually disturbed by the mutinies of the troops and the rebellions of the nobles. By degrees, however, Henri, through the astute counsels of his minister Sully, and by his own personal popularity, raised the power of the crown higher than ever, while he began a system of thorough administrative reform, which was only arrested by his assassination by the fanatic Ravaillac. During the minority of his son,

Louis XIII. (1610–1643), cardinal Richelieu, under the nominal regency of Marie de' Medici, the queen-mother, ruled F. with a firm hand, although his oppression of the Protestants at home, and his co-operation with them abroad, in endeavoring to humble the house of Austria, entailed long and costly wars with little fame on France. Cardinal Mazarin, under the regency of the queen-mother, Anne of Austria, exerted nearly equal power for some time during the minority of Louis XIV. (1643–1715). The wars of the Fronde, the misconduct of the parliament, and the humbling of the nobility, gave rise to another civil war, but with the assumption of power by young Louis, a new era commenced, and till near the close of his long reign, the military successes of the French were most brilliant, and the boundaries of F. were enlarged very nearly to what they were before the war of 1870–71. The military glory of the kingdom was maintained by a host of gallant commanders, amongst whom stood conspicuous the names of Turenne, Vauban, Luxembourg, Catinat, Vendôme, Boufflers, and Créqui, while, by the far-sighted policy of the minister Louvoie, a well-organized army and a newly-created navy made the power of F. formidable to all neighboring nations. The progress of the people in the arts of peace was not less marked. At the close of his rule, the oppressive war-taxes, the prodigality of the court, the luxurious lives of the clergy, and the absolutism and bigotry of the aged monarch, combined to undermine the foundations of national prosperity and freedom, and at his death the state was left trammeled with a debt of 3,500 millions of livres, and his youthful heir, Louis XV. (1715–75), succeeded to a heritage whose glory was tarnished, and whose stability was shaken to its very foundations. The long inglorious reign of Louis XV. presents nothing worthy of notice except the gradual rise of those sentiments of infidelity and license which prepared the overthrow of all the ancient institutions of the country. The regency of the profligate Orleans paved the way for the miseries which followed, while his corrupt financial administration brought the nation into the most overwhelming monetary embarrassments. In this reign, Corsica was added to France. The thorough disorganization of the state, and the neglect of the fleet and army, prevented all attempts at conquests either on sea or land. The colonies were left a prey to the attacks of other powers, while the capricious change of policy which the king's mistress, Mme. Pompadour, forced upon the government, brought contempt upon the country. The peace of Paris, 1763, by which the greater portion of the colonial possessions of F. were given up to England, terminated an inglorious war, in which the French had expended 1850 millions of francs. The close of this unhappy reign was still further disturbed by the cabals of the Jesuits, who were finally banished in 1764. In 1774, Louis XVI., a well-meaning, weak prince, succeeded to the throne. His first ministers, Maurepas, Turgot, and Malesherbes, had not the vigor to carry out the reforms which their sense and patriotism suggested to them, and they were soon compelled to yield to the intrigues of the nobility, and resign their places. They were succeeded by the financier Necker, who endeavored, by economy and method, to arrest the impending bankruptcy of the state, and succeeding ministers made futile attempts to diminish these financial disorders by new forms of taxation, which were generally opposed either by the assembly or the court. The American war of freedom had disseminated republican ideas among the lower orders, while the assembly of the notables had discussed and made known to all classes the incapacity of the government, and the wanton prodigality of the court. The nobles and the *tiers état* were alike clamorous for a meeting of the states; the former wishing to impose new taxes on the nation, and the latter determined to inaugurate a thorough and systematic reform. After much opposition on the part of the king and court, the *etats généraux*, which had not met since 1614, assembled at Versailles on the 25th of May, 1789.

F. was at that moment ripe for a revolution. Although the nobility was exceedingly numerous (as not only did the children of a noble belong to this class, but its numbers were constantly being increased by creation), there were great differences in the rank and dignity attached to the order; thus, in 1789, there were only 44 secular peers, independently of the princes of the blood, and the six originally created ecclesiastic peers; but the lower grades of nobility were so numerous that their numbers stood in the ratio of 1 to 250 of the entire population. Nevertheless, every grade of nobility exempted its holder from the payment of the ordinary land-tax, or *taille*, from the charge of maintaining the public roads (*corvée*), from military conscription, from receiving billets of soldiers, etc. The nobles paid the *capitation* tax, but in a very unequal proportion, although the landed property was vested almost entirely in their hands. They, in fact (together with the clergy), monopolized the principal share of the national revenues, and left to the lower classes the burden of labor and of paying the taxes. At the outbreak of the revolution, the French nobility were sunk in profligacy, and fallen to the lowest stage of demoralization. The clergy kept pace with the nobles in general depravity, and while their aggregate revenues amounted, according to Necker, to 130,000,000 of livres, and their landed property stood in the relation of 1 to 5¼ of that of all other proprietors, their contributions towards the maintenance of the state were inadequate and irregular. The open profligacy and excesses of many of the higher members of the hierarchy, moreover, brought the whole order into disrepute. Francis I. had wrung from the church a tithe, known as the *décime paschaline*, and every five years the clergy were expected to present their so-called *dons gratuits ordinaires*, of from 15 to 18 million

of livres; while on occasions of need they from time to time made extraordinary *dons gratuits*, which, however, were usually paid at long intervals. The *tiers état* were crushed by the weight of an unjust taxation, which was rendered more obnoxious by the system of farming out some of the taxes. The most tyrannical of these was the tax on salt. The municipal institutions which had been permitted to flourish under some of the Valois princes in the middle ages, were almost entirely abolished, and the offices of towns, like those of the state and the courts of justice, were either hereditary or open to purchases. The *tiers état*, which included professional men, and all who were not either members of the noble or the clerical orders, saw themselves utterly excluded from all participation in the privileges and duties of free citizens, at the very time when the extensive circulation of the writings of the philosophers of the 18th c., as Voltaire, Malesherbes, Rousseau, and Montesquieu, had habituated men's minds to the discussion of questions of political independence, equal rights, and universal freedom.

The resistance made by Louis and his advisers to the reasonable demands of the deputies on the 17th June, 1789, led to the constitution of the national assembly—a measure which was followed, on the 23d of June, by a declaration of the inviolability of the members. The king retaliated by ordering a large body of troops under arms, dissolved his ministry, and banished Necker, whom he had shortly before recalled under the pressure of public opinion. The consequence was the outbreak of insurrectionary movements at Paris, where blood was shed on the 12th July. On the following day, the national guard was convoked; and on the 14th, the people took possession of the Bastile. The provinces repeated the acts of Paris, and everywhere national guards and revolutionary municipal councils were called together. On the 4th of Aug., feudal and manorial rights were abrogated by the national assembly, which gave expression to a solemn declaration of the equality of human rights. The royal princes and all the nobles who could escape sought safety in flight. The royal family having attempted in vain to follow their example, tried to conciliate the people by the feigned assumption of republican sentiments; but on the 5th Oct., the rabble, followed by numbers of the national guard, attacked Versailles, and compelled the king and his family to remove to Paris, whither the assembly also moved. The next two years witnessed the solemn inauguration and the subsequent retraction of various constitutional schemes; the princes of the blood and the ancient noblesse raised corps of emigrés in different parts of the country, but their efforts could not arrest the spread of republicanism. The king alternately made concessions to the republicans, and cherished schemes for escaping from their surveillance, but each month added to his humiliations and to the audacity of those surrounding him. A war with Austria was begun in April, 1792; and the defeat of the French was visited on Louis, who was confined in Aug. with his family in the temple. The advance of the Prussians into Champagne threw Paris into the wildest excitement. The national assembly dissolved itself in Sept. In Dec., the king was brought to trial, and called upon to answer for repeated acts of treason against the republic. On the 20th Jan., 1793, sentence of death was passed upon him; and on the following day he was beheaded. Revolts burst out in every part of France. England, Holland, Spain, Naples, and the German states combined together against the republic. Christianity was now formally deposed, and the sacredness of the republic and the worship of Reason solemnized. Marie Antoinette, the widowed queen, was guillotined; the dauphin and his surviving relatives suffered every indignity that malignity could devise. A reign of blood and terror succeeded. Danton and Robespierre, after having condemned countless numbers to the guillotine, suffered each in turn a similar fate. After the destruction of the terrorists, a reaction was gradually established; the people were wearied of bloodshed, and anxious for peace and order at any cost. The brilliant exploits of the young gen., Napoleon Bonaparte, in Italy, turned men's thoughts to other channels. In 1795, a general amnesty was declared, peace was concluded with Prussia and Spain, and the war was carried on with redoubled vigor against Austria. The revolution had reached a turning-point. A directory was formed to administer the government, which was now conducted in a spirit of order and conciliation. In 1797, Bonaparte and his brother-commanders were omnipotent in Italy. Austria was compelled to give up Belgium, accede to peace on any terms, and recognize the Cisalpine republic. The glory of the French arms was re-established abroad, but at home the nation were still suffering from the shock of the revolution. The directory repudiated two thirds of the national debt, and thus almost ruined the commerce and credit of France. Under the pretext of attacking England, a fleet of 400 ships and an army of 36,000 picked men were equipped; their destination proved, however, to be Egypt, whither the directory sent Bonaparte; but the young gen., resigning the command to Kleber, landed in F. in 1799, and at once succeeded in supplanting the directory, and securing his own nomination as consul, conjointly with Sièyes and Roger Ducos. In 1800, a new constitution was promulgated, which, although in appearance purely constitutional, in reality vested the sole executive power in Bonaparte, who showed consummate skill in reorganizing the government, to which he imparted a systematic efficiency and a spirit of centralization, that secured a thoroughly practical administration. Having resumed his military duties, he marched an army over the Alps, attacked the Austrians unawares, and decided the fate of Italy by his victory at Marengo. In 1801, the peace of Lunéville was concluded, and the boundaries of F.

were extended to the Rhine. England was the only country which refused to recognize the legality of the various Italian and German conquests of F.; and with the exception of a brief period of peace, this country remained the implacable foe of Bonaparte from the days of the consulate to his defeat at Waterloo. Every period of respite from war was employed by the first consul in reinstating trade and industry, and in obliterating both in private and public life the stains left by the reign of terror. In 1804, on an appeal by universal suffrage to the nation, Bonaparte was proclaimed emperor. The pope came to Paris to crown him and his wife Josephine; a new nobility was rapidly created, and the relatives and favorites of the emperor received vanquished kingdoms and principalities at his hands. For a time, Napoleon's influence with the weakened powers of the continent succeeded in maintaining an injurious system of blockades against England; and, except in the peninsula, his arms were everywhere victorious. By his marriage with the archduchess Maria Louisa, daughter of the emperor of Germany, Napoleon seemed to have given to his throne the prestige of birth, which alone it had lacked. He now availed himself of the freedom afforded by the peace with Austria to expand the material prosperity of the country, by encouraging trade, constructing roads, bridges, and canals in every part of the empire, and by consolidating his government, and organizing a complete code of laws and a systematic mode of administering them. But this period was the poorest in respect to the literary and scientific development of the nation, who were too much trammeled by police supervision and military discipline to exercise freedom of thought and intellect, and this interval of comparative repose was soon interrupted by the ambitious designs of Napoleon on Germany, which led to a declaration of war against Russia in 1812. From this time to his final defeat in 1815, the emperor rapidly receded from the lofty station he had won for himself. The disastrous Russian campaign, in which his noble army was lost amid the rigors of a northern winter, was soon followed by the falling away of his allies and feudatories. Napoleon himself was still victorious wherever he appeared in person, but his generals were beaten in numerous engagements; and the great defeat of Leipsic compelled the French to retreat beyond the Rhine. The Swedes brought reinforcements to swell the ranks of his enemies on the e. frontier, while the English pressed on from the w.; the senate and his ministry betrayed his cause, and the allies threw themselves on Paris, which, in the absence of the emperor, capitulated after a short resistance, Mar. 30, 1814. Napoleon now abdicated in favor of his young son, and retired to the island of Elba, the sovereignty of which had been granted to him. His wife and son removed to Vienna; his family were declared to have forfeited the throne; F. was reduced to her former limits, and the provinces she had acquired were restored to their national rulers. On the 3d May, Louis XVIII. (the brother of Louis XVI.) made his entry into Paris. The conduct of the Bourbons did not conciliate the nation; they returned loaded with debts, and surrounded by the old nobility and clergy, who had not renounced their former privileges, and who looked upon the generation of Frenchmen who had arisen during their absence as their natural enemies. A narrow spirit influenced the weak policy of the king, which led to the establishment of a strict censorship, the extension of the powers of the police, and the persecution of all the adherents of the empire; while the lower classes and the army, who were alike sensible of the humiliating reaction which had followed the former excitement of war and conquest, were treated with an indifference, and even contempt, by the returned emigrés, to which they were wholly unaccustomed. On the 1st Mar., 1815, Napoleon left Elba, and landed in France. Crowds followed him; the soldiers flocked around his standard; the Bourbons fled, and he took possession of their lately deserted palaces. The news of his landing spread terror through Europe; and on the 25th Mar., a treaty of alliance was signed at Vienna between Austria, Russia, Prussia, and England, and preparations at once made to put down the movement in his favor, and restore the Bourbon dynasty. At first, the old *prestige* of success seemed to attend Napoleon; but on the 18th June, he was thoroughly defeated at Waterloo; and having placed himself under the safeguard of the English, he was sent to the island of St. Helena, in conformity with the generally acknowledged sentiment, that it was necessary to the peace of Europe to remove him finally and definitely from the scene of his former power. The second restoration gave occasion to many pledges of a more liberal policy on the part of Louis, but few of them were fulfilled, and a general and sullen discontent reigned among the people, who were again deprived of all voice in the administration, or in the election to offices, and were harassed by the petty tyranny of the priests, who were the favorite advisers of the crown. In 1821, Napoleon breathed his last at St. Helena; and in 1824, Louis XVIII. died without direct heirs, and his brother, the duc d'Artois, succeeded as Charles X. The same ministerial incapacity, want of good faith, general discontent, and excessive priestly influence characterized this reign, which was abruptly brought to a close by the revolution of 1830, and the election to the throne of Louis Philippe, duke of Orleans, as king, by the will of the people. Legitimist insurrections disturbed the nation; one *émeute* succeeded another; attempts upon the king's life were frequent; but the progress in material prosperity made the government popular with the *bourgeoisie*, or middle classes, and for a time it held its ground. The warlike propensities of the nation found an outlet in the war in Algeria (q.v.) with Abd-el-Kader. But the determined resistance of the king to

the growing desire for electoral reform, led at last to open insurrection in Paris; and Louis Philippe having abdicated (Feb. 24, 1848), a republic was proclaimed, under a provisional government. An insurrection of the red republicans in Paris (June, 1848), was only put down after great slaughter. Louis Napoleon (q.v.) was elected president of the republic in Dec., 1848; but by the famous *coup-d'état* of Dec. 2, 1851, he violently set aside the constitution, and assumed dictatorial powers; and a year after (2d Dec., 1852), was raised, by the almost unanimous voice of the nation, to the dignity of emperor as Napoleon III. His rule was one of complete absolutism, under which, however, F. made great advances in the development of her natural resources, and in manufactures. Assuming the character of an adjuster of the wrongs of nations, Napoleon proclaimed himself a mediator in the Danish and Austro-Prussian wars, and the defender of the Italians against Austria, of the pope against the people of Italy, and of the Mexicans against the government of the United States of America. By his help the Italians were relieved from the Austrian yoke, and the pope was left master of Rome; but in Mexico his intervention only led to greater bloodshed, and ended ignominiously for the glory of F., and fatally for the cause and life of his protégé, the Austrian prince Maximilian (q.v.). Attempts to gain a Prussian alliance ended in humiliating repulses. Although the brilliant success of the Paris exhibition of 1867 seemed to afford evidence of the personal and national consideration in which the emperor was held, his political credit had already then lost its importance. At home, the great financial embarrassments of his government were arousing the discontent of the people; and to avert the growing disaffection, Napoleon offered (1869) to adopt a constitutional form of government, and to make some concessions in regard to freedom of the press. It was soon found that the responsibility of the ministry was fictitious, and that the emperor availed himself of its protection to cloak his own acts of personal government. The result of the appeal made to the nation in 1870, on the plea of securing their sanction for his policy, was not what he had anticipated; and the 50,000 dissentient votes given by the troops in this plébiscite, revealed a hitherto unsuspected source of danger. Confident in the efficiency of the army, and anxious to rekindle its ardor, he availed himself of a pretext to declare war against Prussia. The course of events in the short but terrible Franco-German conflict of 1870–71 electrified Europe by its unexpected character, revealing at once the solidity of Prussian strength, and the hollowness of imperial power in France. Within a fortnight of the emperor's appearance at the head of his troops at Metz, July 28, 1870, the strength of the French army was annihilated, Alsace and Lorraine were occupied by Germans, and the chamber of deputies in Paris was clamoring for his abdication. On Sept. 2, Napoleon, with his army of 90,000 men, surrendered at Sedan, and on the 4th, Paris was in rebellion, the senate dissolved, the empress regent a fugitive on her way to England, and F. proclaimed a republic amid tumultuous excitement. Before the close of Sept., Strasburg, one of the last hopes of F., had capitulated, and Paris was completely invested by German troops; and on 5th Oct., the Prussian king had taken up his head-quarters at Versailles. The fall of Metz, with 200,000 men, completed the disasters of the year. In Jan., 1871, the united efforts of the different branches of "the provisional government of defense," respectively installed at Paris and Tours, succeeded in bringing about an armistice, after the besieged Parisians had for four months been hourly exposed to the fire of the enemy, cut off from all communication with the outer world except by balloons and carrier-pigeons, and finally threatened by famine. With the concurrence of Prussia, the French nation now proceeded, by a general election of representatives, to provide for the exigencies of the country. The first national assembly of the French republic met at Bordeaux in February. After receiving from the provisional government of defense the resignation of the powers confided to them in Sept., 1870, the assembly undertook to organize the republican government, and nominated M. Thiers chief of the executive power of the state, with the title of president of the French republic, but with the condition of responsibility to the national assembly. On the 1st of Mar. the preliminaries of peace were finally ratified at Bordeaux, the chief conditions being that the province of Alsace (except Belfort) and part of Lorraine, including Metz, should be ceded to the German empire, and that F. should pay a war indemnity of 5,000 millions of francs, and continue to be occupied by German troops till the money was all paid. This enormous obligation was discharged in Sept., 1873, and during the same month, F., after an occupation of three years, was finally relieved from the presence of foreign troops. In the spring of 1871, the peace of F. was seriously threatened by a successful outbreak at Paris on the part of the communists (q.v.), who, after great bloodshed and grievous damage to public and private property, were quelled by the regular army, which had sided with the government, and on 20th of May order was restored in Paris. Since then, F. has been successfully trying to obliterate some of the numerous misfortunes resulting from the war, and commerce and national prosperity are beginning to revive. The ex-emperor Napoleon died in 1873, at Chiselhurst, where he had resided with his family since his liberation in Mar., 1871. In 1873, M. Thiers resigned the office of president of the French republic, and was succeeded by marshal MacMahon, who soon had his presidential powers confirmed to him for a period of seven years, generally known as the septennate. The president's sympathies were conservative, and especially in 1877 he was suspected of

reactionary designs. But the republican form of government was greatly consolidated, during MacMahon's tenure of office, and continued to secure more and more the confidence of the nation. On the resignation of MacMahon (q.v.), M. Grévy (q.v.) was appointed his successor.

FRANCE, Isle of. See Mauritius.

FRANCESCHI'NI, Baldassare, 1611–89; a painter of the Tuscan school. He was more successful in fresco than in oil painting. His pictures were not unfrequently left unfinished, but many perfected specimens remain, the smaller ones being marked by much originality of conception. The best known of his large oil paintings is "St. John the Evangelist," in a church at Volaterra. One of his latest undertakings was the fresco of the cupola of the Annunziata, a production of much labor and energy.

FRANCESCO DIPAULA, founder of the order of the *Minims*, was b. in 1416, at Paula or Paolo, a village of Calabria. At the age of 12, he was the inmate of a Franciscan convent; and at 14 he retired to a cave, where he inflicted on himself every species of self-mortification. The fame of his piety having attracted to his cell several emulators of his austere life, he received permission to erect a convent, and the new community received from pope Sixtus IV. the title of the hermits of St. Francis. To the usual conventual vows, F. D. added one of the most rigorous abstinence—flesh, eggs, and milk being strictly forbidden the entire year, except in illness. Popular report having attributed to F. D. several wonderful cures, Louis XI. of France, the most superstitious of monarchs, being severely ill, summoned him to his presence, in hopes of some miraculous display of power in his behalf. F. D. repaired to France, where he was received with the highest honor, and attended the king on his death-bed. The successors of Louis, Charles VIII. and Louis XII., treated F. D. with great favor, consulted him in important matters, and induced him to settle in France. Charles VIII. built him a convent at Plessis-le-Tour, and another at Amboise. F. D. died at the former in 1507, and was canonized in 1519.

FRANCHE COMTÉ, an old province in the e. of France, in the basin of the Rhone, comprised what now forms the departments of Doubs, Haute-Saône, and Jura, and had for its capital Besançon.

FRANCHISE. In its political acceptation, the F. may be said to be the right which centers in the individual holding it to exercise a certain limited portion of the general sovereignty of the state. A F. in this sense is possible only in a free state, i.e., in a state in which the governed, as a whole, are identical with the governers. It does not necessarily involve the idea of representative government; for where legislation is effected by the votes of the people themselves, as it was in the small states of antiquity, the F. is exercised by each individual directly, without the intervention of any representative machinery. Where representation has been introduced, the F. is the right which the citizen has of voting for his representative, not the right of voting in the legislative body conferred on the representative in consequence of being sent thither, and is an expression not of the sovereignty which centers in him, but of that which belongs to the constituents who send him. There would be no theoretical inconsistency, however, in applying the term F. to the right of voting in the house of lords, which belongs to each peer, because he here exercises the sovereignty, or original freedom which belongs, or is supposed to belong, to himself, and does not represent that of others. As the F. is the political expression of the sovereignty which centers in each free citizen, the extent or value which ought to belong to the F. will be measured by the amount of the sovereignty which it expresses. But this sovereignty again corresponds, or finds forms of actual expression, in the social position which the individual occupies, in the amount of power and influence which is conceded to him by the society of which he is a part. A theoretically just F., then, would be one which corresponded accurately to the social position of each individual, which translated the verdict by which society fixed his status into the language of politics. But scientific accuracy in such matters, for obvious reasons, is unattainable. An approximation in the individual case is all that is possible in dealing with the mass, and one of the questions which is at present most keenly discussed amongst speculative politicians is, by what test shall this approximate estimate of social value be brought most nearly to the truth. Mr. J. S. Mill has proposed intelligence, as indicated by instruction, as the sole measure of individual sovereignty, and, consequently, as the basis of the F. (see his work on Representative Government). Others have proposed wealth; whilst by a third class of speculators it is contended that, in the case of each individual, there are various elements of social importance which must be taken into account in determining the political value which is his due. By all the more recent writers on the theory of government, however, the idea of all citizens being entitled to an equal suffrage, however great might be the disparity of intelligence, wealth, manhood, and other elements which go to make up social importance, is repudiated as a scientific absurdity, and reprobated as the source of all the practical injustice which results from what are commonly known as democratic governments. See Mill's work, alluded to above; also Parliament.

FRANCHISE in England is a royal privilege, or branch of the crown's prerogative, subsisting in the hands of the subject. Being derived from the crown, franchises must arise from royal grant, or in some cases may be held by prescription, which presupposes a grant (Stephen's *Com.* i. 637). The subjects of F. being the peculiar property of the crown, correspond with what in Scotland are called regalia (q.v.); and a F. is analogous to a grant of regalia. Gifts of waifs, estrays, wrecks, treasure-trove, royal fish, and forfeitures, all of which are the prerogatives of the crown, are franchises The rights of forest, chase, park, warren, and fishery are also franchises, no subject being entitled so to apply his property for his own convenience. A county palatine (see PALATINE) is the highest species of F., as within it the earl, constable, or other chief officer, may exercise without control the highest functions of the sovereign. And as the crown may thus erect an entire county into an independent jurisdiction, so it may create a liberty or bailiwick independent of the sheriff of the county. This, then, is another species of franchise. It is likewise a F. for a number of persons to be incorporated, and subsist as a body-politic, with a power to maintain perpetual succession, and do other corporate acts; and each individual member of such corporation is also said to have a F. or freedom. The right to hold a fair or market, or to establish a ferry, and to levy tolls therein, is also a franchise. Where the holder of a F. is disturbed in his right, he may sue for damages by an action on the case; or in the case of non-payment of tolls, he has the remedy of distress (q.v.). Franchises may be extinguished by reunion with the crown, or may be lost by *misuser*—that is, such a use of them as is contrary to the express or implied condition on which the royal grant proceeded—or by *non-user*.

FRANCIA, FRANCESCO (Francesco Raibolini), 1450–1517; a painter of Bologna, the son of a carpenter, was apprenticed to a goldsmith with whom he learned to make dies for medals, becoming so famous for such work as to be made mint-master in his native city. It was only in his maturer age that he turned his attention to painting. He was the friend and correspondent of Raphael, and the great master asserted that few painters had produced more beautiful Madonnas than those of Francia. He was the founder of a school, and has been regarded as second only to Raphael in the brilliancy of his genius.

FRANCIA, Dr. JOSÉ GASPAR RODRIGUEZ, Dictator of Paraguay, was the son of a small landed proprietor, of French or Portuguese origin, and was born near the town of Asuncion in 1757 or 1758. He was intended for the church, studied at the university of Cordova de Tucuman, where he took his degree as a doctor of divinity or of canon law, and was for some time a theological professor. Subsequently he adopted the profession of law, to the practice of which he continued to devote himself for a period of thirty years, gaining much reputation for learning, skill, honesty, and independence of character. When he had attained the age of 52 or 53, the revolution which shattered the Spanish yoke in South America broke out in Buenos Ayres. Paraguay at first offered active opposition to the revolutionists, but ultimately sought to obtain independence for itself. F. took a leading part in the movement, and was made secretary of the independent junta set up, but he soon resigned his post. The conviction, however, being strong in the public mind that F. alone could properly direct the affairs of the new republic, he was, in 1813, appointed joint-consul along with gen. Yegros. The latter, however, was a man apparently without much intellect or energy, and F. was really sole ruler from the first. In 1814, he was appointed dictator for three years, at the expiry of which time the dictatorship was given him for life; and the absolute control so conferred he exercised until his death in 1840. Under F., the condition of Paraguay rapidly improved, and the system of non-intercourse, political or commercial, with other nations, which he enforced, however much it may seem to prove him devoid of administrative sagacity, was undoubtedly attended with good results to his country. So strict were the regulations against foreign intercourse, that ingress to, or egress from, Paraguay was next to impossible; and F.'s treatment of some foreigners who did get in (among others the famous savant Bonpland), and of others who were prevented entering, savored of harshness, and even barbarism. Yet his administrative talent was of a high order. He improved agriculture, making two crops of corn grow where only one had grown before. He introduced schools, promoted education, repressed superstition, and enforced strict justice between man and man in his law courts. His death was regretted by the people as a public calamity—the best proof that he was no vulgar tyrant. See Rengger and Longchamp's *Essai Historique*, etc. (Paris, 1827); *Francia's Reign of Terror* (London, 1839), by J. P. and W. P. Robertson, two young Scotchmen whom F. turned out of the country; and T. Carlyle's essay in the *Edinburgh Review* (1843).

FRANCIABI'GIO, 1482–1525; a Florentine painter, and partner of Andrea del Sarto, in conjunction with whom he painted, in 1513, the "Marriage of the Virgin," a portion of a series undertaken for the court of Servi in Florence. The friars having uncovered this work before it was quite finished, Franciabigio was so incensed that seizing a mason's hammer, he struck at the head of the virgin and destroyed it, as well as several of the others; and the fresco, which would otherwise have been his masterpiece in that method, remains thus mutilated to the present day. At Lo Scalzo, in

another series of frescoes, on which Andrea was also employed, he executed, in 1518–19, the "Departure of John the Baptist for the Desert," and the "Meeting of the Baptist with Jesus;" and at the Medici palace at Poggio a Caiano, in 1521, the "Triumph of Cicero." Various works which have been ascribed to Raphael are now known or reasonably supposed to be by Franciabigio. Of these we may name the "Madonna del Pozzo," in the Uffizi gallery; the half figure of a "Young Man," in the Louvre; and the famous picture in the Fuller-Maitland collection, a "Young Man with a Letter." These two works show a close analogy in style to another in the Pitti gallery, avowedly by Franciabigio, a "Youth at a Window;" and to some others which bear his monogram. The series of portraits, taken collectively, place the genius of the master beyond dispute.

FRANCIS I., King of France, son of Charles, comte d'Angoulême, was b. at Cognac, Sept. 12, 1494, and in his youth manifested an ardent love for literature, especially for the romances of chivalry, whence, probably, he drew his brilliant but erroneous views of a kingly character. At the age of 20, he married Claude, daughter of Louis XII., and succeeded his father-in-law, Jan. 1, 1515. His first act, after mounting the throne, was to set about the reconquest of Milan, which had been wrested from his predecessor two years before; and at the head of 40,000 men, among whom were such great warriors as the constable Bourbon, Bayard, Lautrec, and Trivulzio, F. crossed the Alps, and attacked the Swiss allies of the Milanese at Marignano, 10 m. from Milan. Here a sanguinary battle, afterwards called the "battle of the giants," ensued (13th Sept., 1515), in which F. obtained a complete victory—the Swiss losing 12,000 men. In accordance with his chivalrous propensities, F. accepted knighthood on the field from the renowned Bayard. After some further successes, F. returned to Paris in the month of Feb., 1516. On the death of Maximilian, emperor of Germany, in Jan., 1519, F. and Charles of Spain became rival candidates for the imperial crown. The election of the latter excited the anger of F., who immediately prepared for war, and endeavored to secure the alliance of Henry VIII. of England. An interview took place in 1520 between the two monarchs on the famous *field of the cloth of gold*, between Guines and Ardres, but it led to no result, and shortly after, Henry formed an alliance with the pope and the emperor against Francis. The papal troops drove the French out of Italy; and the soldiers of Henry and the emperor invaded France on the n., while, to complete his perplexities, the constable Bourbon, who was discovered to be conspiring against his sovereign, fled to Charles, who gladly accepted the sword of the renegade warrior. F. gallantly faced the dangers that now threatened his kingdom. A large army was sent to Italy under the command of Bonnivet, who, however, proved incapable, and was forced to retreat across the Alps. In the course of this retreat, Bayard lost his life. The imperialists now advanced into Provence, but, on the approach of the French king, withdrew into Italy, whither they were followed by F., who overran Lombardy, but was totally defeated and taken prisoner at the battle of Pavia, 24th Feb., 1525. Charles carried his captive to Madrid, and only granted him his liberty on the hardest conditions. F. had to renounce the suzerainty of Flanders and Artois, the duchy of Burgundy, and all his Italian possessions and prerogatives, to promise the restoration of Bourbon to his former dignities, and to surrender his two sons as hostages. He obtained his freedom, Mar. 17, 1526; but regarding the conduct of Charles as utterly base, his first act, on his return to his dominions, was a refusal to fulfill the pledges he had given. Pope Clement VII. absolved him from his oath; England, Rome, Venice, Florence, and Genoa—all of whom were growing alarmed at the immense power of Charles—withdrew from the imperial alliance, and sided with his antagonist. The war in Italy now recommenced. On the 5th May, 1527, Bourbon's "black banditti" stormed and sacked the "Eternal City," and captured the pope. F. now sent troops into Naples, which, after a series of brilliant successes, were almost wholly cut off by disease, mainly through the negligence of the king, who failed to supply them with the means of subsistence. About the same time, F. sent a challenge to Charles to decide their quarrel by single combat. The challenge was accepted, but the duel never came off. At last, a peace was concluded at Cambray, in July, 1529, much to the advantage of the Spaniards. In 1534, however, war broke out between F. and the duke of Milan; and in the following year the former overran Savoy, to which he laid claim by the absurdest pretensions. The conduct of Charles at this period was marked by the greatest moderation, but he was ultimately reinvolved in hostilities with his inveterate opponent. Little definite result ensued, but the war was marked by a circumstance regarded as horrible in those days—viz., an alliance between Christians and Turks. F. formally entered into a league with the sultan Soliman, who went so far as to land troops in the s. of Italy, but the French king shrunk from a practical co-operation with the arch-enemy of Christendom. By the efforts of pope Paul III., a treaty was concluded for ten years at Nice between Charles and F., 18th June, 1538. In point of fact, however, peace lasted only four years, and in 1542, F., insatiable of glory, launched five different armies against the emperor. The battle of Cerisolles, 14th April, 1544, in which the French were completely victorious, partially wiped out the dishonor of the defeat at Pavia, but a second alliance of F. with the Turks renewed the indignation of Christendom. Charles, and Henry.

king of England, marched upon Paris, and F. was compelled to make peace at Crepy, 18th Sept., 1544. His political rôle was now finished. He died at Rambouillet, Mar. 31, 1547. It is not difficult to estimate the character of this monarch. Gay and voluptuous (it was the physical consequences of an amour which cost him his life), he was still capable of heroic impulses and acts of splendid generosity. But no amount of "chivalry" could compensate for the lack of political sagacity; it could not even save him from deeds of cruelty. His persecution of the Vaudois and other "heretics" has left a dark stain on his memory, which all his patronage of arts and letters will not efface. F. was himself a writer of verses; but these were so bad, that even French critics pronounce them almost intolerable.

FRANCIS II., 1543–60; King of France, eldest son of Henry II. and Catherine de Medicis. He was married to the unfortunate Mary Stuart, daughter of James V. of Scotland, in 1558, and ascended the French throne at the age of 16. He was merely a tool in the hands of his uncles, the duke of Guise and the cardinal of Lorraine. He died suddenly from an abscess in the ear at the age of 17. But for the fact of his marriage with Mary Stuart, Francis II. would scarcely have been remembered in our day.

FRANCIS I. (STEPHEN), Emperor of Germany, born in 1708, was the eldest son of Leopold, duke of Lorraine. On the death of his father, in 1729, F. succeeded him in the dukedom, which, in 1735, he ceded to Stanislaus Leszczynski, father-in-law of Louis XV., to revert after his death to the crown of France. In lieu of Lorraine, he obtained the grand duchy of Tuscany, whose native rulers, the Medicean family, were about to die out. In 1736, he married Maria Theresa of Austria, the only daughter and heiress of the emperor Charles VI. In 1740, Charles died, and Maria Theresa succeeded him; she made her husband co-regent with herself, but gave him little share in the administration. F. fought bravely for his wife's rights in the wars carried on against Frederick the great. In 1745, he was elected to the once important dignity of emperor of Germany, and crowned at Frankfort. The famous seven years' war (1756–63) now broke out between Austria and Prussia; but the cares which it imposed fell mainly upon his leonine consort, Maria Theresa. F. died at Innsprück, 18th Aug., 1765. His son Joseph succeeded him in the imperial dignity, but Maria Theresa retained in her hands the sovereignty of the Austrian dominions till her death.

FRANCIS II., Emperor of Germany, and I. of Austria, the eldest son of Leopold II., grand duke of Tuscany, and of Maria Louisa, daughter of Charles III., king of Spain, was born at Florence, in Feb., 1768. In 1790, his father became emperor of Austria by the death of his brother Joseph, but died only two years after, when the crown devolved upon Francis. The French revolution was now exciting the alarm of the old European dynasties; F. concluded an alliance with Prussia against the new republic; and the armies of the allies marched to the frontiers of France, but soon recoiled before the fiery enthusiasm of the republican troops. In 1794, F. placed himself at the head of the army of the Netherlands, which, on the 26th of April, defeated the French at Cateau and Landrecy; and on the 22d of May, gained the bloody battle of Tournay; but on the whole the fortune of the war was against him; and the triumphs of young gen. Bonaparte in Italy forced him to conclude the treaty of Campo Formio (Oct. 17, 1797). Only two years afterwards, however, F., in alliance with Russia and England, again took up arms, and was at first successful; but the recall of the brave Russian general, Suwaroff, and the return of Bonaparte from the east, quickly altered the state of matters. The great victories won by Moreau at Hohenlinden, and by Bonaparte at Marengo, paralyzed the powers of Austria, and F. was compelled to sue for peace, which was obtained by the treaty of Lunéville in 1801, by which the whole of the left bank of the Rhine was ceded to France. In 1805, the aggressions of France once more excited the jealousy of Austria. F. entered into a new alliance with Russia; and the contest was renewed, but ended more disastrously than ever for the Austrians. The French victories of Ulm and Austerlitz, and the capture of Vienna, completely humiliated F., who, at the peace of Presburg (Dec., 1805), was obliged to surrender the Venetian states and the Tyrol. The German empire was now dissolved, after lasting for 1000 years, and F. assumed the title of emperor of Austria, king of Bohemia and Hungary. In 1809, he recommenced the war with Napoleon, and obtained more success, or perhaps we should say, encountered less loss than on previous occasions. The tremendous battle of Aspern *was* a victory, though not a decisive one, and did much to restore the prestige of the Austrian arms. Still, Napoleon again got possession of Vienna, and dictated terms of peace from the palace of Schönbrunn in Oct. of the same year. In 1810, the French emperor married F.'s daughter, Maria Louisa. A permanent friendly alliance now seemed to be concluded between the two empires; and during the Russian campaign in 1812, the Austrians rendered the French some slight assistance. In 1813, Austria resumed its neutrality; but, after having exerted himself fruitlessly to mediate between France and Russia, F. suddenly joined the allies, helped to win the battle of Leipsic, and followed the Russians and Prussians to Paris in 1814. His subsequent career does not present any points of special importance. He labored honestly and indefatigably for the welfare of his subjects, encouraging the making of roads and canals, and the introduction of manufactures, but his horror of everything revolutionary, excited by his early recollections, and by the cruel death of his aunt, Marie Antoinette, and kept

alive by his long wars with France, had rendered him an absolutist in politics, and a lover of that system of centralization to which Austria continues to cling. F. died on the 2d of March, 1835.

FRANCIS I., 1777–1830; King of the Two Sicilies: was the son of Ferdinand I. and became heir to the throne in 1778. He married a daughter of the emperor Leopold II., who became the mother of the duchess de Berri. He contracted a second marriage with a daughter of Charles IV. of Spain. In 1812, he was appointed regent of Naples by his father, and a constitutional government was proclaimed, but the next year his father deposed him, and dissolved the parliament. In 1815, Francis became governor of Sicily, and in 1820, regent of Naples. In 1825, on the death of his father, he ascended the throne. His reign was marked by corruption, cruelty, and subserviency to Austria. One of his daughters married Ferdinand VII. of Spain, and became the mother of queen Isabella.

FRANCIS II., b. 1836; King of the Two Sicilies; son of Ferdinand II. He married Marie Sophie Amelie, a Bavarian princess and sister of the empress of Austria. He ascended the throne in 1859, and followed his father's system in ruling with an iron hand. When all Sicily, with the exception of Messina, had submitted to Garibaldi, he made strong but unsuccessful efforts to secure foreign intervention in his behalf. After Garibaldi's entrance into Naples the king fled to Capua. There he gathered a considerable army, but was routed by the Garibaldians, and Capua surrendered with 11,000 troops. Francis then retired to the citadel at Gaëta, which, after a short siege, surrended to Cialdini, and the king took refuge on a French frigate. His dominions were afterwards included in the kingdom of Italy, and he selected Rome as his place of residence.

FRANCIS, CONVERS, D.D., 1795–1863; b. Mass., graduated at Harvard, and became a Unitarian minister at Watertown. In 1842, he was a professor of pulpit eloquence in Harvard university. He wrote lives of John Eliot, the apostle of the Indians, and of Sebastian Râle, the Jesuit missionary, for the *American Biography*, as well as memoirs of other celebrated men.

FRANCIS, JOHN WAKEFIELD, LL.D., 1789–1861; b. New York; for many years one of the most eminent physicians of the city. He was of German and Swiss descent; was educated in Columbia collage, and in 1809 received the first degree of M.D. conferred by the college of physicians and surgeons. In 1813, he was lecturer for the college on materia medica and the institutes of medicine, and afterwards filled the chair of materia medica. In 1816, he went to Europe and studied under Abernethy. In 1817, he was professor of the institutes of medicine and of medical jurisprudence, and in 1819 of obstetrics. Dr. Francis was one of the most active members of the New York historical society, and used his influence to promote the study of natural history, fine arts, and typography. He interested himself greatly in the woman's hospital, the state inebriate asylum, and kindred institutions. Among his many publications were *Use of Mercury; Cases of Morbid Anatomy; Febrile Contagion; Anatomy of Drunkenness; Memoir of Christopher Colles;* and *Old New York, or Reminiscences of the past Sixty Years.*

FRANCIS, OF ASSISI, founder of the Franciscan order, and a saint of the Roman Catholic church, was one of the most extraordinary men of his age, and merits a detailed notice, as illustrating in his career all the most remarkable characteristics of the religious life of the middle age. He was born in 1182, of the family called Bernardini, at Assisi, where his father was engaged in trade. His baptismal name was John: but from his familiarity with the Romance, or language of the troubadours, in his youth, he acquired the name of *Il Francesco* ("The little Frenchman"). In his early years, he was remarkable for his love of gayety and ostentatious prodigality; but even then his bounty to the poor was one of the largest sources of his wastefulness. He engaged eagerly in exercises of chivalry and of arms; and in one of the petty feuds of the time, he was taken prisoner, and detained for a year in captivity at Perugia. An illness which he there contracted turned his thoughts from earth; and although he again engaged in military pursuits, a second illness at Spoleto decided his career for life. He now resolved to fulfill literally the counsels of the gospel, and he especially devoted himself to poverty, which, in the mystic language thenceforth familiar to him, he designated as "his bride." Under an impulse which he received while listening to a sermon, he took a vow never to refuse alms to a beggar. He made a pilgrimage to the tomb of St. Peter at Rome, and there offered to God all that he possessed on earth. On his return to Assisi, he exchanged his clothes with a poor mendicant; and disregarding all remonstrance and ridicule, he ever afterwards continued to wear the meanest attire. He gave to a priest who was rebuilding a ruined church the price of his horse, which he sold for the purpose, and even sought to appropriate to the same use the moneys of his father, which, however, the priest refused to accept. To avoid his father's anger, he took refuge in a cave, in which he spent a month in solitary prayer, and from which he returned more than ever confirmed in his enthusiasm. His father, having in vain confined him in a dark room of his own house, cited him before the magistrates, and, on F.'s declining all civil jurisdiction in such a case, before the bishop, in order to compel him to renounce his inheritance. F. abandoned all, even to the very clothes he

wore, and then declared that "till now he had been the son of Bernardini, but that henceforth he had but one Father, Him that is in heaven." Thenceforth, no humiliation was too low for F.; he begged at the gates of monasteries; he discharged the most menial offices; he served the lepers in the hospital at Gubbio in their most revolting necessities, and with the most tender assiduity. He worked with his own hands at the building of the church of St. Damian, and at that of Sta Maria degli Angeli, which he afterwards called his "Portiuncula," or "little inheritance;" and as the last act of self-spoliation, and the final acceptance of the gift of poverty, he threw aside his wallet, his staff, and his shoes, and arrayed himself in a single brown tunic, of coarse woolen cloth, girt with a hempen cord. This was in his 26th year, in 1208. His enthusiasm by degrees excited emulation. Two of his fellow-townsmen, Bernard Quintavalle and Peter Cattano, were his first associates. They were followed, although slowly, by others; and it was not till 1210 that, his brotherhood having now increased to 11 in number, he drew up for them a rule, selected in the true spirit of religious enthusiasm, by thrice opening at random the gospels upon the altar, and taking the passages thus indicated as the basis of the young institute. (Milman's *Latin Christianity* iv. 264.) The new brethren repaired to Rome, where their rule was approved (though at first only *vivâ voce*) by pope Innocent III. in 1210. The two following years were spent by the brotherhood in preaching and exhorting the people through the rural districts of their native and the adjoining provinces; and F. himself returned to Assisi in 1212, at which time he finally settled the simple constitution of his order, the church of Sta Maria degli Angeli being assigned to them as their home. In common with the older forms of monastic life, the Franciscan institute is founded on the three vows of chastity, poverty, and obedience; but of these the second was, in the eyes of F., the first in importance and in spiritual efficacy. In other orders, the practice of poverty consisted in the mere negation of riches. With F., it was an active and positive principle. In other orders, although the individuals could not possess, it was lawful for the community to hold property in common. F. repudiated all idea of property, alike for his order and for its members; he even disclaimed for them the property in those things which they retained for personal use—the clothes which they wore, the cord with which they were girded, the very breviary from which they chanted the divine office. The very impossibility, to human seeming, of these vows, was their strength. Numbers crowded to the standard of Francis. He told them off in parties to different provinces of Italy. Five of the brotherhood repaired to Morocco to preach to the Moors, and, as the first martyrs of the order, fell victims to their holy daring. Success removed all the hesitation with which the institute at first was regarded, and in 1216, the order was solemnly approved by pope Innocent. From this date it increased with extraordinary rapidity. At the first general assembly, held in 1219, 5,000 members were present; 500 more were claimants for admission. F. himself inaugurated the future missionary character of his brotherhood by going (1223) to the east, and preaching the gospel in the presence of the sultan himself; but the only fruit of his mission was a promise from the sultan of more indulgent treatment for the Christian captives, and, for the Franciscan order, the privilege which they have since enjoyed, as guardians of the church of the Holy Sepulcher. It is after his return to Italy that his biographers place the celebrated legend, which, to friends or to enemies, has so long been a subject of veneration or of ridicule—his receiving, while in an ecstasy of prayer, the marks (*stigmata*) upon his own person of the wounds of our Divine Redeemer. The scene of this event is laid on Monte Alverno, a place still sacred in the traditions of the order; and the date is Sept. 17, 1224. Two years later, St. F. died, Oct. 4, 1226. On the approach of his last hour, he requested that he should be carried upon a bier to the church, where he had himself placed on the bare ground, thus realizing in his own death the most literal extreme of the doctrine which he had made in life the basis of his system. He was canonized by pope Gregory IX. in 1228.

The works of St. F. (folio, Pedeponti, 1739) consist of letters, sermons, ascetic treatises, proverbs, moral apothegms, and hymns. The latter are among the earliest metrical specimens of the Italian language. They are exceedingly simple, and full of the tenderest expressions of the love of God. His prose is often more poetical than his poetry itself, abounding in allegory and poetical personification. Few writers have ever turned the love and admiration of external nature to a purpose so beautifully devotional. "Of all the saints," says dean Milman, "St. Francis was the most blameless and gentle." No saint, it may be added, has been the subject of more exaggerated panegyric from the writers of his order; and one of the works in his praise—a parallel between St. F. and our divine Redeemer—is disowned by the Roman Catholic community as a most reprehensible exaggeration, the fruit of an affectionate, but most misdirected zeal for the memory of the founder of the Franciscan order.

See the Bollandist, *Acta Sanctorum*, Oct. 4; St. Bonaventure's Life of St. Francis, with Wadding's notes; Helyot, *Hist. des Ordres Religieux*, tom. vii.; Butler's *Lives of Saints*, Oct. 4; Milman's *Latin Christianity*, vol. iv.; Gieséler's *Church History*, vol. iii.; Hase's *Franz von Assisi;* Mrs. Oliphant's *F. of Assisi* (1871).

FRANCIS, Sir PHILIP, son of the Rev. Dr. Philip Francis, author of a well-known translation of Horace, was b. at Dublin, Oct. 22, 1740, and educated at St. Paul's school,

London, where he had for a school-fellow Henry S. Woodfall, afterwards the printer of the *Public Advertiser*, and the publisher of the *Letters of Junius*. In 1756, he obtained a place in the office of Mr. Fox, then secretary of state, which he retained under his successor, Mr. Pitt. In 1760, he became secretary to the earl of Kinnoul, who had been appointed British ambassador to Portugal; and on his return to England in 1763, he received an appointment in the war-office. Ten years later, he was sent out to India, as a member of the council for the government of Bengal, with a salary of £10,000. Here he came into collision with the governor-general, Warren Hastings, and so far did the quarrel proceed, that a duel was the consequence, in which F. was severely wounded. In Dec., 1780, he resigned his situation, and returning to England, entered parliament for the borough of Yarmouth, in the isle of Wight, in 1784. He never obtained a reputation as an orator, but his great abilities and extensive information always commanded the respect and attention of the house. The prosecution of Hastings, begun in 1786, was hailed by him with malignant joy, and it must be confessed that he displayed a most ungenerous alacrity and activity in furthering the designs of the committee of impeachment. In his political opinions, F. was a decided and consistent whig, at a time when whigism meant very much the same as the radicalism of a later period. He exulted at the success of the French revolution, was an active member of the association of "friends of the people," and ably supported the efforts of Fox and Grey for a reform in the representation of the nation. He withdrew from parliament in 1807, and died Dec. 22, 1818. F. wrote upwards of twenty political pamphlets. He has also been considered by many to have the best claim to the authorship of the *Letters of Junius* (q.v.).

FRANCIS BORGIA, SAINT, 1510–72; duke of Gandia and general of the Jesuits. His father sent him to the court of Charles V., where he married Eleanor de Castro, a Portuguese lady of high rank. He accompanied Charles on his African expedition in 1535. Subsequently, he was made viceroy of Catalonia and commander of the order of St. James. Having had some correspondence with Loyola he resolved to enter the Jesuit order. His wife was dead, and other difficulties were removed by papal dispensation. In 1551, he assumed the habit and became a priest. Three years later he became commissary-general of the order in Spain, Portugal, and the Indies, exhibiting great zeal and energy in founding new colleges and extending the power and influence of the brethren. On the death of Lainez in 1565, he was appointed third general of the Jesuits, and in that capacity labored with such success as to receive from the order the title of "the second founder."

FRANCISCANS, ORDER OF, also called MINORITES OR LESSER BRETHREN, a religious order of the Roman Catholic church, founded by St. Francis of Assisi. For an account of the establishment of the Franciscan order and its earliest fortunes, see FRANCIS OF ASSISI. The subsequent progress of the order was equally wonderful. In less than half a century it reckoned no fewer than 33 "provinces," the aggregate number of convents in which exceeded 8,000, while the members fell little, if at all, short of 200,000. Some idea, indeed, of the extraordinary extension of this remarkable institute may be formed from the startling fact, that, in the dreadful plague of the black death in the following century, no fewer than 124,000 Franciscans fell victims to their zeal for the care of the sick, and for the spiritual ministration to the dying! But this marvelous external progress was accompanied by serious internal controversies and divisions. In the original scheme of the institute, its great fundamental characteristic was poverty, which St. Francis proposed to render in his order not only more perfect theoretically, but more systematical in its practice, than it existed in any of the contemporary institutes. For the accomplishment of this design, the rule which he drew up contained a few brief and simple, but, understood literally, very effectual provisions; but the difficulty of their literal observance led, even in the lifetime of St. Francis, to an attempt in the general assembly of the order to introduce some important modifications; and, though the authority of the founder was sufficient to prevent the adoption of these modifications during his lifetime, and although his last will contained a special clause prohibiting not merely all change of the rule, but even all interpretation of it, the attempt was renewed with still more determination under brother Elias, his successor in the office of general of the order. The great subject of controversy was the nature and extent of the obligation of religious poverty as vowed in the order. Francis desired that it should be understood in the most rigorous sense; and in his scheme of poverty, neither the individual brethren nor the entire community could acquire or retain any right of property, even in things of necessary use. The rigorous party in the order sought to carry out this principle to the fullest extent; and they contended that it was unlawful for the order to acquire a right of property in houses, convents, or even churches; restricting their right in everything which they possessed to the simple use. Several successive popes sought, by explanatory decrees, to settle the dispute; and for a time a compromise was received, by which it was understood that the right of property in all *de facto* possessions of the order was vested in the see of Rome; but the foundations of the real controversy lay deeper than this. They regarded the practice, far more than the theory, of poverty; and the disputes to which they led eventuated not only in the formation of fresh offsets from the body in the new religious orders to be named hereafter, but also

in a large, and, for a time, formidable secession from the church in the sect of the Fraticellians. See FRATICELLIANS.

The supreme government of the Franciscan order, which is commonly said to be the especial embodiment of the democratic element in the Roman Catholic church, is vested in an elective general, who resides at Rome. The subordinate superiors are, first, the "provincial," who presides over all the brethren in a province; and secondly the "guardian," who is the head of a single convent or community. These officers are elected only for two years. The provincial alone has power to admit candidates, who are subjected to a probation of two years (see NOVITIATE); after which they are, if approved, permitted to take the vows of the order. Those of the members who are advanced to holy orders undergo a preparatory course of study, during which they are called "scholars;" and if eventually promoted to the priesthood, they are styled "fathers" of the order; the title of the other members being "brother" or "lay-brother."

A very important feature, however, of the organization of the Franciscan, as it subsequently became of other orders, is the enrollment of non-conventual members, who continue to live in society without the obligation of celibacy; and in general are only bound by the spirit, and not the letter, of the rule. They are called "tertiaries," or members of the third order of St. Francis. See TERTIARY. It is impossible to overestimate the value of this institution in the disorganized social condition of that age. The tertiaries were bound, as the very first condition of enrollment, to restore all ill-gotten goods; to be reconciled with all those with whom they had been at feud; to devote themselves to the practice of works of Christian charity; to avoid all unnecessary expenditure; to renounce the use of personal ornaments; to hear mass daily; to serve the sick and the hospitals; to instruct the ignorant; and, in a word, to practice as far as possible in the world the substance of the virtues of the cloister. The institute, in this form, undoubtedly exercised a powerful influence in mediæval society. It counted members in every rank, from the throne to the cottage; and, although it was in some instances deformed by abuses and superstitious practices, the aggregate results were undoubtedly beneficial.

The Franciscan order has been the parent of many other religious institutes. The earliest of these is that of the "observantists," or "brethren of more strict observance." The origin of this body has been already indicated. The party in this order which contended for the more rigid observance of the rule, after a protracted struggle—in which disaffection to the church itself was often strongly exhibited—obtained a separate organization, which may be said to have been finally settled at the time of Leo X. The less rigid party, under the name of "Conventuals," obtained a distinct general, and an authorization for their mitigated observance of the rule. Their churches and convents admit greater richness of architecture and decoration; and they are at liberty to acquire and retain, in the name of the order, the property of these and similar possessions, all of which are renounced by the observant Franciscans. The latter community nearly 150 provinces. Their constitution is that of the original rule, as already comprises explained. A second offshoot of the Franciscan order, and in the same direction of rigorism, is that known as the "Capuchin," founded by Matteo di Basio, a Franciscan brother of the observant rule in the early part of the 16th century. Believing himself divinely called to revive the old spirit of his order, and learning that the modern habit of the brethren was different from that of St. Francis, he began with externals, and procured for himself, and obtained the papal permission to introduce (1528), the peculiar habit, with a pointed hood or cowl (capute), from which the name of the reformed order is derived. Along with this habit, however, Matteo adopted a very rigorous and mortified course of life, in which he was joined by others of the brethren; and the reform spread so rapidly among the community, that in the year 1536 a general chapter of the new congregation was held. They were subject, however, to the jurisdiction of the general of the Franciscan order. One of the first generals of the new reform was Bernardino Ochino, afterwards notable by his defection to Calvinism. After the council of Trent, the Capuchins multiplied rapidly, though they were not introduced in France till the end of that century. A similar reform, to which the name of "Recollets" was given (introduced in Spain by John de Guadaloupe, in 1500), was approved by Clement VII. in 1532; and many of the new brethren were among the first Spanish missionaries to the new world. A further development of the rigoristic spirit is the congregation of "Discaled" or "Barefooted" (q.v.) Franciscans. The author of this reform was a Spanish Capuchin, Peter of Alcantara. In his capacity of provincial of Estremadura, Peter introduced many reforms; and in 1555 obtained the approval of pope Julius III. for a new rule, which was afterwards confirmed by Pius IV.

The notice of the Franciscan institute would be incomplete without the mention of the several orders of nuns; as those of St. Clare, the Capuchinesses, the Urbanist nuns, etc., which formed part of the same general organization. None of these, however, calls for any detailed explanation, or presents any very fair characteristic features.

The Franciscan order, in these several branches, has at all times maintained its popularity in the Roman Catholic church. When Helyot, in the beginning of the 18th c., published his great *History of Religious Orders*, the Franciscan order numbered nearly 120,000 friars, distributed over above 7,000 convents, and nearly 30,000 nuns, occupying about 900 convents. Since the French revolution, the number has of course been very

much diminished, the order having been suppressed in more than one kingdom; but it is still one of the most numerous in the Roman Catholic church. Many of the foreign missions are mainly supplied by Franciscans, and they possess convents in almost every part of the world.

As a literary order, the Franciscans have chiefly been eminent in the theological sciences. The great school of the Scotists takes its name from John Duns Scotus (see SCOTUS), a Franciscan friar, and it has been the pride of this order to maintain his distinctive doctrines both in philosophy and in theology against the rival school of the Thomists, to which the Dominican order gave its allegiance. See THOMISTS. In the Nominalistic controversy, theThomists were for the most part conceptualists; the Franciscans adhered to the rigid realism. See NOMINALISM. In the free-will question, the Franciscans strenuously resisted the Thomist doctrine of "predetermining decrees." Indeed, all the greatest names of the early Scotist school are the Franciscan St. Bonaventure, Alexander de Hales, and Ockham. The single name of Roger Bacon, the marvel of mediæval letters, the divine, the philosopher, the linguist, the experimentalist, the practical mechanician; would in itself have sufficed to make the reputation of his order, had his contemporaries not failed to appreciate his merit. Two centuries later, the great cardinal Ximenes was a member of this order. The popes Nicholas IV., Alexander V., Sextus IV., the still more celebrated Sixtus V., and the well-known Ganganelli, Clement XIV., also belonged to the institute of St. Francis. In history, this order is less distinguished; but its own annalist, Luke Wadding, an Irish Franciscan, bears a deservedly high reputation as a historian. In lighter literature, and particularly poetry, we have already named the founder himself as a sacred poet. Jacopone da Todi, a Franciscan, is one of the most characteristic of the mediæval hymn-writers; and in later times, the celebrated Lope de Vega closed his eventful career as a member of the third order of St. Francis. We may add that in the revival of art the Franciscan order bore an active and, it must be confessed, a liberal and enlightened part. See Wadding, *Annales Minorum Fratrum*, 8 vols.; see also Milman's *Latin Christianity*, vol. v.

FRANCISCO, SAN. See SAN FRANCISCO.

FRANCIS JOSEPH, the present emperor of Austria, b. 18th Aug., 1830, is the eldest son of the archduke Francis (son of the emperor Francis I.), and Sophia, a princess of Bavaria. Francis was taught to speak all the various languages of his heterogeneous dominions, and only the year before the Hungarian revolution addressed the Magyar nobles at Pesth in their own language—a circumstance which secured him a certain transient popularity. In 1848, he served under Radetzky in the Italian wars. The emperor Ferdinand having, in the hour of his extremity, made certain constitutional promises to the nation, the archduchess, Francis's mother, who during the whole year had directed the schemes of the anti-revolutionary party, resolved that the fulfillment of these promises should be evaded by a change of sovereign. Ferdinand accordingly abdicated in favor of his nephew (2d Dec., 1848), and Francis assumed the government as emperor of Austria, and king of Hungary and Bohemia. Hungary, however, which had lost all faith in the house of Hapsburg, rose in arms, and refused to accede to a change of succession; and Italy again tried the fortune of war. The progress of the struggle between Francis and the constitutionalists of Hungary is described in the biographies of Kossuth, Bem, Dembinski, Batthyani, etc. Suffice it to say that Austria triumphed in Italy, and also in Hungary, through the alleged treachery of Görgei and the help of Russia. Francis now devoted himself, with characteristic persistency, to the re-establishment of "order," that is to say, of despotism. He dissolved the national guard, and took away the freedom of the press, and on Jan. 1, 1852, abolished the constitution of his uncle, which had been a dead-letter from the beginning. In 1853, he nearly lost his life by assassination, and in the Crimean war forfeited the respect of all the belligerents by his indecisive attitude. The *concordat* of 1855, by which certain extraordinary privileges were conferred on the bishops of the Roman Catholic church, was another step backwards. Meanwhile the dissatisfaction of Lombardy, Venice, and Hungary hourly increased. Sardinia encouraged the national feeling in Italy, and at last, in 1859, Francis hurried thoughtlessly into a war with that kingdom, which ended in the cession of Lombardy. For the war with Denmark, see SLESVIG; for the war with Prussia, and the subsequent work of reconstructing the empire. See GERMANY. Francis was crowned as king of Hungary at Pesth in 1867. He was present at the opening of the Suez canal in 1869. See also AUSTRIA, HUNGARY.

FRANCIS OF PAOLA, SAINT, 1416–1507; b. Calabria; founder of the order of Minims. At an early age, for reasons unknown, he retired to a cave by the sea-shore near his native town, and gave himself wholly to a hermit's life, following the example St. Francis, having no bed but the bare rocks, and no other food than the herbs which he gathered in the neighboring woods, or which were sometimes brought to him by his friends. He was joined by some other enthusiasts like himself, and the building of a chapel, in 1436, is generally considered as marking the beginning of the Minimite order. At that time, however, and for many years afterwards, they were mere Eremites of St. Francis, and did not claim to be distinguished from other Franciscans unless by a stricter fidelity to the common principles of the order. In eighteen years, the little community had increased so much in number and in popularity, that it was able to

command sufficient funds to build a large church and monastery in 1454. In 1469, owing to reports which he had received, pope Paul II. sent one of his chamberlains into Calabria to ascertain the actual condition of matters at Paola; the account brought back by him was highly favorable, and resulted in the incorporation of the order of the Eremites, Francis being appointed first "corrector" or superior-general. In addition to the usual vows, a special rule was made, which pledged the members to the observence of a perpetual lent. During the following years, several new convents were founded in Calabria and Sicily; and the fame of Francis for sanctity and miraculous powers increased daily. When Louis XI. of France was seized with his last illness, he despatched a special message to beg of the holy man that he would come and restore him to health. But it was not until he had been commanded by pope Sixtus IV., that Francis could overcome his reluctance to undertake so long a journey on so doubtful an errand; and on his arrival at Plessis-les-Tours, in April, 1782, he replied to the king's entreaties for his intervention to prolong his life, that the lives of kings had their appointed limits, that God's decree was unchangeable, and that for his majesty nothing remained to be done but to resign himself to the divine will and prepare for death. At the request of Louis, Francis remained at Plessis, where he was treated with great respect by that sovereign, and also by his successor, Charles VIII. In 1501–2, a new and stricter constitution was granted to the order by Alexander VI., who at the same time conceded all the privileges and immunities enjoyed by the other mendicant orders, and bestowed upon the Eremites, at the urgent request of Francis, the distinctive name of "Minimi," which has ever since been retained by them. At the same time a lay order of "tertiaries" was sanctioned, under a special rule. In 1506, the fourth vow (to observe a perpetual lent) was made more definite and stringent in its character by Julius II.

FRANCIS DE SALES, SAINT, 1567–1622; b. Savoy; bishop of Geneva, and a well-known Roman Catholic writer. He received his education at a Jesuit college in Paris, studied jurisprudence at Padua, and became an advocate of the senate of Savoy. But his inclinations were towards the church rather than the law. He had received the tonsure as early as 1578, while still a boy at Annecy, very much against his father's wishes, and the spirit shown in this early manifestation of pious self-devotion never forsook him. Notwithstanding all his father's remonstrances, he resolved to enter an ecclesiastical life; and, the office of provost or dean of Geneva becoming vacant, the dignity of this office, which was offered to him, was used as a temptation to secure the father's consent. At length, Francis received holy orders, and entered upon his duties as dean and preacher. He possessed great gifts as a preacher, and his fame soon spread through Savoy. His sermons were marked by great simplicity and persuasiveness. "The only real point of preaching," he said, "is the overthrow of sin and the increase of righteousness;" and the principle of this saying guided him in all his sermons. He preached constantly, and in the simplest and most touching and popular words he could find. His father failed to appreciate his style of preaching, as he had failed to understand his self-denial. "I never refused to preach," Francis tells us, "on the principle of 'give to them that ask you.' My dear father used to hear the bells ringing, and ask who preached. 'Who, but your son,' was often the answer. One day he took me aside and said, 'Provost, you preach too often; even on week days the bells go, and it is always the same story, the provost, the provost! It used not to be so in my day. Sermons were much rarer. But then, to be sure, God knows those were something like sermons —full of learning, well got up, more Latin and Greek in one than you stick into a dozen.'" Francis, however, knew his own mind, and was not moved. "My test of the worth of a preacher," he said, "is when his congregation go away saying not 'what a beautiful sermon,' but 'I will do something.' A man may set forth his own learning and eloquence in a fine sermon, but the true sign of success is when his words induce people to leave off bad habits." And as he preached often, he preached briefly. "The more you say, the less the people remember; the fewer your words, the greater their profit," was his motto. "When a sermon is too long, the end makes one forget the middle, and the middle the beginning." Francis was a man of originality both of mind and character, and destined to become a power in the church to which he had so passionately devoted himself. Accordingly he soon became marked out for arduous work. Savoy was at this time greatly invaded by Calvinistic "heresies." The neighborhood of Geneva—a focus for the dissemination of Protestantism—and the political and military complications arising out of the hostile relations of the duke of Savoy and the king of France, all tended to the progress of Calvinism. Chablais had been invaded, and Protestant ministers long established at Thonon and other towns. For nearly sixty years, in fact, this region had been Protestant, and the people by express stipulation enjoyed the exercise of the reformed religion. A missionary of apostolic fervor and courage was required to recover the lapsed district to the Roman church, and many eyes were turned to the young provost of Geneva, as the only man fitted to grapple with the exigencies of the position. His father, as usual, was the obstacle. He entreated his son not to expose himself to the dangers of such a mission, but Francis felt the call within him, and calmly replied: "I cannot refuse to obey; 'wist ye not that I must be about my father's business?'" The result was that he gave himself for four years

(1594–98) to laborious and self-denying work in the district, often, it is said by his flattering biographers, preaching and administering the offices of his church at the peril of his life. His persuasive eloquence and the apostolic simplicity of his life were at first unsuccessful. The inhabitants of Chablais remained hardened in Protestantism. But more violent measures, some of them reflecting little honor on Francis, at length succeeded in reclaiming the district to the Roman Catholic faith. His success in this work led the pope to believe that he might gain over Calvin's celebrated successor, Theodore Beza; and long conferences were held between the Protestant teacher and the Roman Catholic missionary, but without result. In 1598, Francis was appointed coadjutor bishop of Geneva, and became the official companion, as he had long been the warm friend of Claude de Garnier, the aged bishop who had fostered his talents and largely shaped his career. Some years after this, in 1602, he spent some time in France and especially in Paris, where his preaching attracted great crowds, and his influence was felt from the court of Henry IV. to the poor sisters at Port Royal. Before St. Cyran became the spiritual leader of Angelique Arnaud and others of the devoted band which gathered around him, Francis had given a definite direction to her thoughts and aspirations. It is not the name of Angelique Arnaud, however, but that of another celebrated pietist, who was destined to be associated with Francis de Sales. Shortly after his succession to the bishopric by the death of his aged friend, he met Mme. de Chantal; a character of rare enthusiasm and devotion, whose spirit had been greatly chastened by the loss of her husband and child. She put herself under his direction, cut her beautiful hair, and clothed herself as a religieuse. Her good works were incessant, and she became known as the sainte de Monthélon. At length, Francis prepared a mission for her. Submitting her saintly obedience to various tests, he intimated his decision that she was destined to establish an order for the relief of the sick and poor, the only rules for which were to be "charity and the love of Jesus Christ." The order was not fully established till 1610, but gradually acquired great influence. The relation of the saint to Mme. de Chantal and other devout ladies has been much canvassed. There was much of spiritual coquetry in it, and some of his letters to them contained doubtful sentiments; but there is no reason to doubt the purity of his character, and that his main object was to promote what he considered to be the interests of religion. He liked to be "surrounded by women," but chiefly that he might influence them in the interest of the church. In 1608, Francis published his best known and most valuable work, the *Introduction à la Vie Dévote*, the circulation of which was immense. He became famous through all the Christian world. Henry IV. sought to tempt him by a French bishopric; but he remained true to the country of his birth, and the comparatively quiet and unambitious life which he was able to continue there. [Facts mainly from *Encyc. Brit.* 9th ed.]

FRA'NCKÉ, Aug. Herm., a distinguished German philanthropist, founder of the orphan asylum and several educational institutions at Halle, was b. at Lubeck in 1663. Having studied languages and theology with great application and success, he first attracted attention by his academical biblical lectures in Leipsic, begun about 1685. These were more distinguished for piety, warmth, and zeal, than for attention to the strict and dry orthodoxy then in vogue; and the reception they met with from the public brought on F. envy and persecution as a heretic. He thought proper to yield to the storm, and withdrew in 1690 to Erfurt. In 1692, he obtained the professorship of oriental languages in the newly instituted university at Halle, where he subsequently held a professorship of theology. He also received the pastoral charge of the suburb of Glaucha. The ignorance and poverty of his parishioners gave the first impulse to his benevolent labors. To the neglected poor and children that came to him for alms, he gave instruction on stated days, and as others joined, paying a school-fee of a penny a week, and the numbers rose to some sixty, he divided them into classes, and thus laid the first foundation of his educational establishments. At the same time the thought suggested itself of an orphan asylum, and, in 1698, he laid the foundation of a special building for the asylum. Some years after, he erected a pedagogium, a Latin school, and a boarding establishment connected with it. In 1714, there 1075 boys and 700 girls receiving instruction from 108 teachers under the direction of Francke. He also had a missionary institution for the East Indies. To erect and maintain all these establishments required large sums of money; and it is surprising how F. succeeded in obtaining it without assistance from government. But so high was his reputation for disinterested benevolence, and in such a practical way did he set about his undertakings, never appealing for the charitable aid of others till he had first effected something himself, that contributions flowed in from all parts of Germany, and even from abroad. F. also instituted an apothecary's shop and bookselling in connection with his other operations, and thus obtained a considerable income for their support. Nor amidst all these voluntary labors did he neglect his duties as professor and pastor; he preached and lectured regularly, and also found time to study and write. He died June 8, 1727.

Francke's institution, as it now exists in Halle, embraces the orphan house and schools erected by F., together with others since added; the number of pupils amounting in all to upwards of 3,500. Bookselling, printing, and a laboratory for the preparation and distribution of medicines are also carried on in connection with education.

The revenues consist of the profits of this industry, of the income from some property in land and and funds, and of an allowance of £6,000 from the state. The education imparted retains its religious character, but the excessive number of prayers and the otherwise conventual and ascetic character of the discipline have been diminished.

FRANCKEN, a family of painters of Antwerp, eleven in number, living in the 16th and 17th centuries. A similarity of Christian names leads to much confusion in classifying their works. When Franz the first found a competitor in Franz the second, he took the name of "the elder," the second being "the younger." But when the third Franz became a rival of the second, the latter took the name of "the elder," and Franz the third became "the younger." The eldest of the Franckens, NICHOLAS of Herenthals, died in 1596. None of his works are known. JEROME, his eldest son, was occupied chiefly in Paris, where he was engaged in decorating the palace of Fontainebleau, where some of his paintings remain. Others are to be found in the Dresden museum, the Amsterdam museum, and the Brunswick gallery. The second son of Nicholas, b. 1544, was the FRANZ FRANCKEN "the first." He studied under Floris, and left a number of his works in Antwerp and Dresden. AMBROSE, third son of Nicholas, left more works than both his brothers. The best of them are the "Miracle of the Loaves and Fishes," and the "Martyrdom of St. Crispin," in the Antwerp museum. Franz "the first" trained his sons to the profession. The third of these sons is FRANZ FRANCKEN "the second," who also signed himself "the younger;" and "the elder" Franz Francken "the second," 1581-1642, was president of the guild. FRANZ FRANCKEN "the third," the last of the name worthy to be mentioned, died in 1667 at Antwerp.

FRANCK, or FRANK, SEBASTIAN, 1500-43; a German writer, studied at Heidelberg, and, about 1524, ordained to the priesthood. He became associated with the reformers, and in 1528, was married at Nuremberg. The same year, he translated Athanasius's *Reconciliation of the Contradictions of the Scriptures*, and two years later, a *Chronicle and Description of Turkey*, which appeared with an introduction by Luther. In 1531, he published, in Strasburg, his *Chronika*, one of the earliest German synopses of universal history. He removed to Esslingen, and afterwards to Ulm, where at first he received the freedom of the city, but afterwards fell into disfavor on account of the publication of a work entitled *Paradoxa*, and, in 1539, he was finally banished. From that time until his death, he never resided long in one place. He was associated at first with the reformers, but did not sympathize fully with them, tending towards a loose liberalism in thought, and even incurring the condemnation of Luther, who called him a "devil's mouth." His historical works, though not critical, show remarkably the modern attention to social conditions. He wrote also several works of minor importance. He is regarded by some as the forerunner of modern German mysticism.

FRANCO-GERMAN WAR (GERMANY, *ante*). There has probably never been a more frivolous cause given for modern warfare than that alleged by the French nation for declaring war against Prussia. June 26, 1870, ex-queen Isabella of Spain formally abdicated the throne in favor of her eldest son, prince Alphonso. July 5, the foreign governments were notified of her abdication, and on the same day the fact was made public that prince Leopold of Hohenzollern had consented to become a candidate for the vacant throne of Spain. This consent was said to have the approval of the king of Prussia. Thereupon the French government, being unable to view the project of placing a Prussian prince on the Spanish throne otherwise than as a menace to the security of French territory, demanded from king William, through count Benedetti, the French ambassador, that not only as the head of the Hohenzollerns, but also as king of Prussia, he should give assurance that he would prevent prince Leopold's acceptance. At the first audience, July 9, the king replied to this request that, as in the whole affair he had been addressed only as the head of the family, and never as the king of Prussia, and had accordingly given no command for the acceptance of the candidature, he could also give no command for withdrawal. July 12, Leopold's father, the prince Hohenzollern, destroyed all cause or shadow of pretext for war, by withdrawing his son's name from the candidacy for the Spanish throne; but France made a new demand, proposing to the king that he should expressly pledge himself never to give his consent in case the question of the candidature should at any time be revived. The king decidedly refused to comply with such demand, and declared to the French ambassador that he reserved to himself for that eventuality, as for any other, the right to be guided by circumstances. In consequence, the French government, deeming itself called upon to take immediate steps for the defense of its honor and its injured interests, formally declared war against Prussia, July 19, 1870. While the popular enthusiasm in both countries in favor of war either was or soon became about equal, there proved to be a great difference as to military preparations. The French army in 1870 was represented to number on a peace footing 400,000 men; and the emperor Napoleon naturally conjectured that it could be raised in time of war to twice that number, when the national guard and all branches of the service were included. But according to the best military authorities the number of troops in the active army at the beginning of the war was about 427,000, with about 87,000 regular reserve troops in addition to these; and the additional number of men who could be called upon in case of urgent necessity was

only 157,000. Although France had been preparing for the war during the months of May and June, the only section of the active troops ready for marching orders was the so-called "army of the Rhine." This force that marched as rapidly as possible to the Rhenish frontier did not exceed 310,000 men according to the highest estimates. In Germany, however, instead of falling below the estimates, the number of troops was largely increased by the support given to Prussia from the s. German states of Bavaria, Würtemberg, Hesse-Darmstadt, and Baden, whose neutrality, if not actual opposition to Prussia, Napoleon had expected. Prussia had on a peace footing 480,000 men, which, in addition to the standing army of the s. German states of 170,325 men, gave Germany an immense advantage from the beginning of the war. That country had 447,000 troops ready for the first battle, besides a first reserve of 188,000, and a second reserve of 225,000, without including the "landwehr," nearly corresponding to the militia of the United States.

From these forces three armies were formed. The first, under gen. von Steinmetz, was placed near Treves, forming the right wing; the second, under prince Frederick Charles, was sent to the Rhenish palatinate; the third, under the crown prince of Prussia, took its position on the frontier of Baden. The French forces were scattered over a line of 85 to 90 m. in length. The first corps, under marshal MacMahon, was placed near Strasburg; the fifth corps, under gen. Failly, along the frontier of the palatinate; the third corps, under marshal Bazaine, near Metz; the second corps, under gen. Frossard, not far from the Prussian frontier, near St. Avold; the fourth corps, under gen. Ladmirault, near Thionville; the reserve force, under gen. Bourbaki and marshal Canrobert, was partly at Nancy and partly at the camp of Châlons; the seventh corps, under gen. Felix Donay, held the fortress of Belfort. These were the positions of the two contending armies towards the end of July, 1870. On the 23d of that month, Napoleon appointed the empress regent of France, and on the 28th left Paris with the prince imperial to take command of the army at Metz. The king of Prussia left Berlin to take his place in the field, July 31, accompanied by gen. von Moltke and count Bismarck, and on Aug. 2d established his head-quarters at Mentz. On the same day the French corps made an attack on the Prussian position, at Saarbrück, in presence of the emperor and his son. After protracted firing the Germans retreated, and the French occupied Saarbrück. The results of this engagement were unimportant. The first serious conflict of the war took place Aug. 4, at Weissenburg, where the German advance-guard was attacked by the French under gen. Abel Douay; it ended after a battle of five hours with the French troops retiring in great disorder. Gen. Douay was killed, and the Germans took 500 prisoners. The Germans had now 520,000 men and 1170 guns ready for fighting orders, while the entire force of the French (with reserves) amounted to only 350,000 men. On Aug. 6, a bloody battle was fought at Saarbrück (Spicheren) between gen. Steinmetz with 120,000 men, and gen. Frossard with 60,000 men. The Germans stormed the heights of Spicheren, and the French force was thrown back in disorder on Forbach and Metz. The Germans captured 2,500 prisoners, and each army was estimated to have 4,000 dead and wounded. On the same day, at Woerth, the crown prince attacked MacMahon, where he was strengthened by divisions of the corps of De Failly and Canrobert. The French suffered a terrible defeat, and lost 6,000 prisoners, including 100 officers; also 6 mitrailleuses, 35 cannon, 200 horses, and a military chest with 220,000 francs. Thus both wings of the French army were completely defeated; the original position could no longer be held, and all the French corps gathered into two large masses to retreat along the line of the Moselle. Two different armies were thus formed—the army of Metz, commanded by marshal Bazaine from Aug. 12, on which date the emperor withdrew as commander-in-chief; and the army of Châlons, commanded by marshal MacMahon. By Aug. 14, the first German army had advanced to the immediate neighborhood of Metz, and by a successful attack upon the third French corps, baffled the first attempt of the French to retreat to the line of the Marne. This developed later into the battle of Courcelles; the Prussian force engaged was about 80,000 men; the French troops numbered about 60,000. The battle was a mitigation of disaster to the French, and a fearfully bloody success to the Prussians, who lost from 4,000 to 5,000 in killed and wounded. It ended with the retreat of the French troops into the fortifications, and secured to the forces of prince Frederick Charles sufficient time to cut off the French army concentrated at Metz. On Aug. 16, the battle of Mars-la-Tour was fought, at which the entire French army of the Rhine, was repulsed by prince Frederick Charles, and driven back on Gravelotte, though with an immense loss to the Germans. On the 18th, occurred the great battle of Gravelotte, in which 280,000 Germans fought against 160,000 Frenchmen. The French army, occupying a very strong position to the w. of Metz, was, after nine hours' fighting, completely defeated, cut off from its communications with Paris, and driven back towards Metz. The losses were very heavy. The French lost 609 officers and 11,605 men; the Germans 904 officers and 19,658 men. The result was that the French army was shut up in the fortress of Metz. On Aug. 30, MacMahon was beaten, and driven from Beaumont across the Meuse to Mouzon; and on Sept. 1st, 1870, was fought the battle of Sedan, the Waterloo of the second empire, at which gen. Wimpffen commanded the French forces, marshal MacMahon having been wounded the day previous in the struggle near Bazeilles. The army of the Meuse and the third army, after a hot contest, drove the

French from all sides to the fortress of Sedan, where, surrounded and defeated, the entire French force surrendered, with the emperor, who was carried prisoner to Wilhelmshöe. By this capitulation, 84,433 men, 39 generals, and 230 officers of the staff and 2,095 subaltern officers became prisoners of war. On Aug. 31st, while MacMahon was fighting at Sedan, Bazaine made a sortie from Metz, attempting, during that day and the following, to break through toward the north, but was driven back into the fortress. In spite of all precautions the news oozed out at Paris, to the dismay of the imperialists. On Sept. 4, 1870, the third republic was proclaimed, with a government of national defense, of which the chief members were Thiers, Jules Favre, Jules Simon, and Gambetta. Gen. Trochu was its military head. Gradually the Germans closed in on Paris, no serious resistance in the field being attempted. The first siege of Paris lasted from Sept. 19, 1870, to Jan. 30, 1871. In Dec., 1870, at Versailles, the king of Prussia was proclaimed emperor of the new empire of Germany. Gambetta, who escaped from Paris in a balloon, used incredible efforts at Tours to raise fresh armies for France. Before the end of Oct. the capitulation of Metz had released a whole German army, part of which was sent to assist in the siege. At last, Jan. 28, 1871. an armistice was announced, which brought the despairing resistance of Paris to an end. The war elsewhere died out almost at once; the Germans occupied all the forts around Paris. The new republican government of France now had M. Grévy as president, and Thiers chief of the executive power; and it was decided that the assembly should sit at Versailles. On the 18th of Mar., however, the commune of Paris declared itself in opposition to the Versailles republic, and marshal MacMahon was instructed by the Versailles assembly to reduce the insurgent capital. Then followed the second siege of Paris, from April 2 to May 21, with its accompanying horrors. Meanwhile Thiers, after great toil, and with journeys from court to court of Europe, had succeeded in getting peace agreed to. The treaty of Frankfort was signed May 10, 1871. By it Alsace and a large part of Lorraine were ceded back to Germany, while Belfort, which the Germans had taken, was restored to France; and France engaged to pay five milliards of francs as a war indemnity.

FRANÇOIS, ST., is the name of two towns in the French West Indies.—1. St. F. in Guadeloupe stands on the Grand Terre, the more easterly of the twin islands into which the colony is divided by an arm of the sea known as Salt river. It contains about 6,600 inhabitants, about 5,600 of them having been slaves down to 1848, the epoch of emancipation under the French republic.—2. St. F. in Martinique possesses a good harbor on the e. coast. Of a pop. of 5,966, 4,272 had been slaves.

FRAN'COLIN, *Francolinus*, a genus of birds of the family *tetraonidæ*, closely allied to partridges. They are natives of Europe, Asia, and Africa. One species only, the EUROPEAN F. (*F. vulgaris*), is found in the most southern parts of Europe.

FRANCO'NIA (Ger. *Franken*). This name was first applied to those districts on both sides of the Maine which were originally peopled by colonies of Franks, under Thierry, the eldest son of Clovis, who inherited the Germanic possessions of his father on the death of the latter in 511. Under the Merovingian and Carlovingian dynasties, this province acquired a certain degree of preponderance in the state, and enjoyed the privilege of electing the king of the Germans within its own territories, and crowning the sovereign by the hands of its archbishop (Mayence), who was primate of the empire. In 911, Conrad, the count or duke of F., for there is some doubt which of these titles was at that time borne by the ruler of the province, was raised to the throne; and a century later, after the ducal dignity had been recognized in F., the choice of the electors again fell upon the Franconian house, which, by its direct and collateral branches, gave kings and emperors to Germany from 1024, when Conrad II. began his reign, till 1250, when the indirect line of the Hohenstauffen family became extinct. During its connection with the crown, F. increased in extent and importance, while its great spiritual principalities of Mayence, Spires, Worms, and Würzburg acquired both wealth and political influence. In the course of the following 200 years, the province underwent various modifications, and was subdivided into numerous territories, as those of the Rhenish county-palatine, Nassau, Katzenellnbogen, Hainau, the landgravate of Hesse, etc., until the name of F. was limited to the eastern portions of the ancient duchy, which included Würzburg, Fulda, Bamberg, Nürnberg, Hohenlohe, etc. In 1512, Maximilian I. re-established the circle of F., which then embraced the sees of Bamberg, Würzburg, and Eichstädt, Baireuth, and Anspach, and several counties and cities. With the dissolution of the empire, the name of F. disappeared from among the political divisions of Germany; but since 1837, it has been revived in the kingdom of Bavaria (q.v.), where those portions of the ancient Franconian province, which in modern times have been known as the circles of the upper Maine, Rezat, and lower Maine, are now designated upper, middle, and lower Franconia. Upper F. includes the n.e. portion of Bavaria. It is watered by numerous rivers, as the Maine, Raab, Saale, etc., and is intersected by the Fichtelgebirge and by the hilly ranges of the Böhmer-, Franken-, and Steiger-Wald. The valleys produce good crops and fruit, and the district is rich in minerals. Pop. '71, 540,963; capital, Baireuth. Middle F., which abuts upon Würtemberg, is intersected by branches of the Franconian Jura chain, but has few rivers of importance besides the Regnitz and Altmühl, which are connected by the great Ludwig canal. It

produces good wine, but is principally celebrated for its hop-gardens. Anspach and Nürnberg are the principal towns. Pop. '71, 583,417. Lower F., with Aschaffenburg, which occupies the n.w. part of Bavaria, is the richest and best cultivated of the Franconian circles, and is celebrated for the excellence of its wines, the Steiner and Leister. The district is noted for its mineral springs at Kissingen, Brückenau, Orb, and Wipfeld. Pop, '71, 586,122; capital, Würzburg. Small portions of F. were ceded to Prussia in 1866. The pop. of the three Franconias in 1875 was 1,758,048.

FRANCONIA MOUNTAINS, a cluster of the White mountain group, in Grafton co., N. H., separated from the main group by the Notch. Mt. Lafayette, or the Great Haystack, is 5,290 ft. above the sea. Echo lake, Eagle cliff, Profile rock, Bald mountain, Walker's falls, the Basin, the Flume, the Pool, and Georgiana falls, are points of interest.

FRANC-TIREURS, bands of French soldiers that sprang into existence during the progress of the Franco-Prussian war (1870–71). They did not form a part of the regular army, and at first their military organization was very imperfect; but this defect was afterwards in some measure remedied. They exercised a species of guerrilla warfare, attacking small detachments of the enemy, as also single travelers, baggage-trains, etc., their attacks being too often characterized by those savageries incident to this mode of warfare. They consisted mostly of the rural population; but their birth, education, clothing, arms, age, and even their aim, were almost in every case different. At first, they were not recognized by the Germans as having any military standing at all, and when seized they were shot; but after a time, when they received a better organization, and co-operated with the regular French army, such recognition was accorded them.

FRANEKER, a handsome t. of the Netherlands province of Friesland, on the canal between Harlingen and Leeuwarden. It was formerly the seat of a university founded in 1585 by the Frisian states on the suggestion of prince William Louis, count of Nassau, which ranked among its professors the eminent names of Vitringa, Schultens, Hemsterhuis, Valckenaer, and others. It was, however, abolished by Napoleon in 1811, and in 1816 was transformed into an athenæum, to which a physiological cabinet and botanic garden belong. F. has a lunatic asylum with (1874) 255 patients. Pop. 6,570.

FRANGIPANI, an illustrious and powerful Roman house, which traces its origin to the 7th c., and attained the summit of its glory in the 11th and 12th centuries. In the early annals of Rome, several members of this family occupied important public offices, and seem to have taken a prominent lead in all matters of moment. In 987, Crescenzio Frangipani successfully vindicated the prerogatives of the Roman people against the encroachments of pope John XV. The rivalry of the F. house with that of the Pietro Leoni, not only occasioned repeated civil wars in the state, but likewise several schisms in the church. The luster of their race was finally outshone by the two great patrician families, Colonna and Orsini, whose magnificence, power, and pretension far exceeded those of the greatest citizens of Rome. Two of the last of the F. who merit mention are Giovanni, who captured Conradin of Hohenstaufen, and delivered him, in 1268, to his sanguinary enemies; and Latino, grand inquisitor and cardinal and bishop of Ostia and Velletri. The origin of the name Frangipani is attributed to the family's benevolent distribution of bread in time of famine.—The Croatian family of the same name claim descent from the great original Roman house.

FRANK, FRANKING LETTERS. On the introduction of the uniform penny-postage on all inland letters in 1840 (3 and 4 Vict. c. 96), the privilege formerly enjoyed by peers and members of the house of commons, and many official persons, of "*franking*," as it was called, that is, sending and receiving letters duty free, was abolished: the statute 7 Will. IV. and 1 Vict. c. 32, by which this privilege had been recently regulated, being repealed by s. 68 of the first-mentioned act. The privilege was claimed by the house of commons in 1660, when the post-office was first legally established (see POST-OFFICE), but it was afterwards dropped upon a private assurance from the crown that it should be allowed to members. The postmaster-general accordingly constantly issued a warrant directing the allowance, till the privilege was expressly conferred by statute 4 Geo. III. c. 24. In the days of franking, each member of either house of parliament was entitled to send 10 letters every day, not exceeding an ounce in weight each, to any place in the United Kingdom, and to receive 15, free. As it was not necessary that the letter should be either written by or to the privileged person, the privilege was greatly abused; and most persons whose memories reach back to the period when it existed, will remember family arrangements for taking advantage of it, by which the whole correspondence of the kindred, connections, and even the intimate acquaintances of a peer, or a member of parliament, was in general carried on duty free. Up to the passing of the last-mentioned statute (12th July, 1837), all that was requisite was that the member should write his name or title on the corner of the letter. From this time, however, till the abolition of the privilege, it was required that the whole address should be written by the member; that he should add not only his name, but the name of the post-town, and the day of the month; and what was most troublesome of all, that the letter should be posted on the day on which it was written, or the following

day, and in a post-town within 20 m. of which the person franking was then actually resident. By this cruel regulation (7 Will. IV. and 1 Vict. c. 35, s. 9), the kindly custom of giving franks to friends, or leaving them with them for future use, was rudely interfered with, and the public mind reconciled to the final abolition of what many regarded as a time-honored abuse.

FRANK, FRANKING LETTERS (*ante*), in the United States established as a system before the adoption of the federal constitution, and continued with various modifications until the last day of June, 1873. At first granted only on letters of revolutionary soldiers who were in actual service, its privilege was afterwards extended to the president, the heads of departments, the chiefs of bureaus, and certain clerks designated by the postmaster-general. Public documents were also sent free. It was further extended to senators and congressmen for matter addressed by or to them, with certain limitations, before and after the sessions of congress; postmasters could frank official correspondence; newspapers were exchanged free, and petitions to congress were sent free, but the weight of packages was limited to 4 ozs. each. A further extension included the exchanges of the Smithsonian institution, medals, and testimonials granted to soldiers. Since July 1, 1873, when the whole franking system was set aside, an allowance of stamps has been made to the various departments to cover the expense of correspondence and of the transmission of reports and documents.

FRANK, JACOB JOSEPH, 1712–91; b. in Poland; was the founder of a Jewish sect named Frankists, after himself, and Zoharites, after their sacred book. When a young man traveling in the east, the Turks called him a Frank, which was their common appellation for a European. This surname he always retained. After his return to Poland he settled in Podolia, where he became famous as a Cabalist and gathered around him many persons skilled in the mystical science, some of whom were rabbis. The doctrine which he taught, drawn from that of the celebrated false Messiah *Sabbathai Sevi*, he published in a book which his followers regarded as inspired of God. The rabbis, becoming jealous, annoyed him in many ways and procured his arrest; but the Roman Catholic clergy obtained his release, and the king authorized him to profess his belief openly. His followers now, in their turn, were severe on their adversaries until they were checked by the opposition of the papal nuncio at Warsaw. Some of them escaped to Moldavia, and others, among whom was Frank himself, professed to embrace Christianity. He was baptized at Warsaw, the king standing by proxy as his sponsor. Soon afterwards he was charged with heresy and imprisoned. When the Russians invaded Poland (1773), he was released by them, and finding that his adherents had greatly increased he gathered large collections from them in Poland and Bohemia. From Vienna he went to Brunn in Moravia, where he lived luxuriously on the money which his followers supplied. On his way to the daily public service, he rode in a gorgeous carriage, followed by persons on splendid horses and in glittering attire. In 1786, he removed to Offenbach, where he displayed even greater magnificence, declaring himself to be the messiah, and regarded as immortal by his adherents, until he was stricken down with apoplexy. The sect still exists in Poland, numbering among its members persons in all classes of society.

FRANKALMOIGNE (Lat. *libera eleemosyna*, free alms) was a gift of lands to those who were consecrated to the service of God. By the ancient common law of England, a man could not alien lands which came to him by descent without consent of his heir, but he might give a part to God in free alms. It was an old Saxon tenure, and continued under the Norman revolution, through the great respect that was shown to religion and religious men. This is the tenure by which almost all the ancient monasteries and religious houses held their lands, and by which the parochial clergy and very many ecclesiastical foundations hold them at this day. The statute of 12 Car. II. c. 24, which abolished the old tenures, specially reserved tenure in Frankalmoigne. The condition on which lands in F. were held was, that masses and divine services should be said for the grantor and his heirs, but no particular service was specified. At the reformation, the nature of the services was changed, but the tenure was suffered to continue. A tenant in F. did no fealty to his overlord, and in the event of failure to perform the service, the latter was not entitled to distrain, but might complain to the ordinary or visitor. In this respect, this tenure differed from tenure by divine service, i.e., where lands were given on condition of performing a specified service, as saying a mass on a particular day, or distributing certain alms. In this case, the tenant was bound to render fealty, and the lord was entitled to distrain on failure to perform the service. But lands held in F. were subject to the *trinoda necessitas*, of repairing highways, building castles, and repelling invasions. F. was a tenure, to be held of the grantor and his heirs; all lands, therefore, now held in F., unless created by the crown, must have been granted before the reign of Edward I., for by *Quia emptores*, 18 Edw. I., all grants by subjects to be held of the grantor and his heirs are ineffectual. In Scotland, lands conveyed to the church *in puram eleemosynam* were said to be mortified. See MORTIFICATION.

FRANKENBERG, a flourishing manufacturing t. of the kingdom of Saxony, is situated on an affluent of the Mulde, 32 m. s.w. of Dresden. It has manufactures of cottons, woolens, silk-stuffs; also, dye-works and cigar manufactories. In addition to

the other elementary and advanced educational establishments, F. possesses a trade school and an agricultural seminary. Pop. '75 10,462.

FRANKENHAU'SEN, a small t. of Germany, in Schwarzburg-Rudolstadt, stands on the Whipper, 27 m. n.n.w. of Weimar. It has a palace, a higher school, and a seminary for teachers. There are here very productive salt springs, a large sugar refinery, with manufactories of cigars and articles in mother-of-pearl. In the neighborhood are anthracite mines. Pop. '75, 5,500. F. figures in history as the scene of a battle between the rebellious peasants under Thomas Münzer, 15th May, 1525, and the Saxon, Brunswick, and Hessian troops, in which the former were defeated.

FRANKENSTEIN, a small but active t. of Prussia, in the province of Silesia, is situated on a height on the left bank of the Pause, 37 m. s.s.e. of Breslau. Six m. s.w. of F. is the mountain fortress of Silberberg (still existing, but not maintained as a fortress since 1860), the defenses, bastions, and casemates of which are almost entirely hewn out of the solid rock. These works were constructed by Frederick the great, in order to command the passage from Bohemia. Pop. '75, 7,492, who are engaged in the manufacture of broadcloth, linen, aquafortis, strawplait, saltpeter, etc.

FRANKENTHAL, a prosperous manufacturing t. of Germany, in the Bavarian palatinate, is situated on the Isenach, 16 m. n.n.w. of Spires. From the town a canal between 50 and 60 ft. broad extends e. to the Rhine, a distance of 3 miles. It has important cloth manufactures, cotton and linen weaving, and manufactures of gold and silver wire, and of needles, files, and tobacco. Pop. '75, 7,907.

FRANKFORT, a city in Franklin co., Ky., the capital of the state, on both sides of Kentucky river (which is crossed by bridge), and on the Louisville, Cincinnati and Lexington railroad, 29 m. w.n.w. of Lexington, and 65 m. e. of Louisville; pop. '70, 5,396—2,335 colored. The river is navigable for steamboats both above and below. The city stands on a high plain, and is regularly and handsomely laid out. The surrounding country affords some very fine scenery. On one of the hills near the city is a cemetry in which lie the remains of Daniel Boone and those of several governors and other leading people of the state; and there is a fine monument to the soldiers of Kentucky who fell in the war of 1812 and the Mexican war. Among the prominent buildings are the state-house, governor's house, court-house, penitentiary, the state home for feeble minded children, the Kentucky military institute, etc. There are manufactures of flour, cotton, whisky, etc., and trade in timber and other produce. The city was begun in 1787, and five years later became the seat of the state government.

FRANKFORT, COUNCIL OF, attended by 300 bishops from Germany, France, Spain, Italy, and England, was held in 794 at Frankfort-on-the-Main, by order of Charlemagne, to consider the decision of the second council of Nicæa concerning the worship of images; and the doctrine of Adoptianism as advanced anew by Elipandus and Felix. The second council of Nicæa, held 787 A.D., having passed a decree sanctioning the worship of images, the pope sent a copy of it to Charlemagne in order to obtain the approval of the French bishops. But that monarch earnestly opposed the decree, and either personally wrote, assisted perhaps by Alcuin, or directed Alcuin in writing for him, the celebrated Caroline books, which strongly condemn every act or appearance of worship paid to images, even to bowing the head and burning lights before them. In arguing, for instance, against the plea that images are necessary to perpetuate and call up the memory of holy things, the writer says, "Unhappy memory which, in order to think of Christ who should never be absent from the heart, needs the presence of an image, and can enjoy his presence only by seeing his image painted on a wall. We Christians, who with open face beholding the glory of the Lord are changed into the same image from glory to glory, are no longer bound to seek the truth in images and pictures." These Caroline books were read as part of the discussion at the council of Frankfort. The decision of the council was against the worship of images and against the second council of Nicæa for sanctioning it. Elipandus, archbishop of Toledo, and Felix, bishop of Urgellis, also a city of Spain, revived the opinion, formerly advanced by theologians of Antioch, that Christ in his human nature was the Son of God only by adoption. This language seems to have been sometimes used merely as synonymous with the assumption of human nature by the divine nature of Christ, and therefore as meaning only that Christ the Son of God became man. But its appropriate figurative sense is that Christ's human nature, being only human, was adopted by God, as a man may adopt as his own the son of another. In this sense it was regarded as carrying out the Nestorian doctrine to its extreme results in maintaining that, since Christ, in his human nature, was the Son of God only by adoption, there could be no proper union of his divine and human attributes. It was in this sense, probably, that the council of Frankfort condemned the opinion as heretical. Felix professed to recant it, but afterwards advanced it anew. Elipandus also, secure in his extreme age and in the protection of the Saracens, violently maintained it. It did not, however, gain many new adherents and did not survive its immediate authors.

FRANKFORT-ON-THE-MAIN (Ger. *Frankfurt-am-Main*), a city in the Prussian province of Hessen-Nassau, is situated on the right bank of the Main, in lat. 50° 6' n.

and long. 8° 41′ east. Till 1866, Frankfurt was the foremost, as it was the most ancient, of the four free cities of the German confederation, and the seat of the diet. The city lies in a wide and fertile valley at the mouth of the Main, and is encircled by a belt of villas, gardens, vineyards, and orchards. In respect of commerce and wealth, Frankfurt is one of the most important cities of Germany; by the census of 1875, its population amounts to 103,315, of whom upwards of 7,000 are Jews. Frankfurt is the center from which radiate public roads and railways to every part of Germany; while its site on the banks of the Main, 20 m. from its confluence with the Rhine, by affording it a direct channel of water-communication with the German ocean, secures to it great advantages as a seat of commerce. Its central position has pointed it out from the earliest ages of the history of Germany as a suitable place for national meetings, and in 794 Charlemagne convoked a council here. In 843, Frankfurt was made the capital of the eastern Frankish empire, and continued so till 889, when Arnulf transferred that honor to Ratisbon; in 1257, Frankfurt was raised to the dignity of a free city; and in 1356, Charles IV. confirmed by the famous "Golden Bull" the right, which it had enjoyed since the days of Frederick Barbarossa, of being the place for the election of the emperors of Germany. The guildhall, or *roemer*, contains the wahlzimmer, or hall of election, in which the electors (q.v.) met to deliberate on the nomination of the emperors, and the *kaisersaal*, or imperial hall, in which the newly elected monarch held his public dinner, at which he was waited upon by the counts and high officers of the empire, who held their respective domains and offices in right of their performing various acts of service on that occasion. Round this hall are ranged in niches the portraits of the emperors from Conrad to Leopold II. The golden bull is preserved among the archives. The ancient cathedral, St. Bartholomew's, contains the chapel in which the electors accepted the emperor after he had been anointed at the high-altar. Frankfurt still contains many old and narrow streets with high-gabled projecting houses, but its ancient walls and ramparts have been converted into pleasure-walks, and there are now broad quays, and wide handsome streets in the more modernized parts of the city. The gates of the famous *Juden-gasse*, which were closed at night to prevent the egress of the Jewish inhabitants, were razed at the time of the French occupation in 1806; and the street is now more than half demolished, almost the whole of the western side having been pulled down. Frankfurt is connected with its suburb, Sachsenhausen, which lies on the left bank of the Main, by three bridges (one dating from 1342, another hardly yet finished), besides the railway bridge and a wrought-iron suspension bridge for foot passengers. There are fountains in several of the squares, one of which is adorned with a fine statue of Goethe, who was born at Frankfurt, and another with a group commemorative of the invention of printing. Frankfurt possesses several good public libraries, museums, and galleries, and many charitable institutions. It derives great wealth from its banking transactions; the aggregate capital of its bankers, among whom the name of the Rothschilds has long stood foremost, is said to be about 20 millions sterling, and the annual transactions in bills of exchange about 12 millions sterling. Its manufacturing industry has greatly extended since the annexation to Prussia; to the former manufactures of snuff, tobacco, jewelry, printers' black, wax-cloths, and carpets, have been added type-founding, chemical works, and the manufacture of sewing-machines on a large scale. As a free city, Frankfurt possessed a small territory of about 39 sq.m. outside its precincts, and was governed by 2 burgomasters (elected annually), 4 syndics, a civic committee of 21 members, and a legislative chamber of 57 members; the highest court of appeal was the supreme tribunal at Lübeck. The constituent assembly elected in 1848 to frame a constitution for Germany, held its sittings at Frankfurt. At the outbreak of the Austro-Prussian war in 1866, Frankfurt chose the side opposed to Prussia. On the 16th July, gen. von Falckenstein entered the city, a fine of 31 millions of florins being imposed; and on the 18th Oct., Frankfurt was formally incorporated with the Prussian state. It was in Frankfurt that peace was finally concluded between Germany and France in 1871, the treaty having been signed on the 10th May, in the Swan hotel here, by Bismarck and Jules Favre.

FRANKFORT-ON-THE-ODER, the capital of an extensive Prussian circle of the same name in the province of Brandenburg, is a place of considerable trade, on the railway line between Berlin and Breslau, and about 50 m. e. of the former city. Frankfurt lies in lat. 52° 22′ n., and long. 14° 33′ east. Pop. in 1875, 47,176. It is a handsome, well-built town, and has three suburbs, one of which lies on the right bank of the Oder, and is connected with the remainder of the town by a wooden bridge. Of the six Protestant churches, St. Mary's, founded in the 13th c., is the most worthy of notice, for its large organ, richly-gilt wood-carvings, and fine stained windows. The university, founded in 1506, was incorporated in 1811 with that of Breslau, but Frankfurt still has its distinct gymnasium, with its branch-schools. Three great fairs are still annually held at Frankfurt, but although they are still attended, as of old, by many Poles and Silesians, sales are less brisk than in former times. Frankfurt has manufactures of iron-ware, porcelain and pottery, sugar, felt, bone-dust, liquors, chocolate, paper, leather, silk, and wool stuffs. Its situation on a navigable river, connected by canals with the Vistula and the Elbe, affords great commercial and social advantages, which have rendered it a place of importance from a very early period. It was a flourishing member of the Hanseatic

league, and during the middle ages it suffered frequently at the hands of marauding enemies. It was besieged in 1430 by the Hussites, in 1450 by the Poles, and in 1477 by the duke of Sagan. In the thirty years' war, it was frequently taken by both parties, and at the beginning of the present century it suffered severely at the hands of the French. Frankfurt is the seat of the administrative government, judicial tribunal, council of nobility, and boards of taxation for its circle. The village of Kunersdorf, 4½ m. from Frankfurt, was the scene of a great battle, fought Aug. 12, 1759, between Frederick the great and the Russo-Austrian forces, in which the former was compelled to retreat with great loss.

FRANKFURTER, MOSES BEN SIMEON, about 1700–62; a Jewish scholar of Amsterdam. The *Great Rabbinic Bible*, edited by him, was an important contribution to the study of the Jewish Scriptures, supplying the text for the subsequent editions of the Hebrew Bible.

FRANK'INCENSE, *Thus*, a name employed to designate various fragrant resinous substances which diffuse a strong fragrance in burning, and are on that account used in certain religious services. There is good reason to believe that the F. of the Jews, and also of the ancient Greeks and Romans, was chiefly or entirely the substance now known as *olibanum* (q.v.), the produce of an Indian tree, *Boswellia serrata* or *thurifura*. See BOSWELLIA. It was formerly supposed to have been obtained from the *juniperus lycia*, which is now believed not to yield any such product, and is a native of the s. of Europe, whilst the prized F. of the ancients was brought from the east.—Several trees, however, of different natural orders, yield substances used as F. instead of olibanum, in different parts of the world, as several species of *icica* and of *croton* in America; and the silver fir (see FIR) in Europe, the resinous product of which is the COMMON FRANKINCENSE of the pharmacopœias, although in the shops, concrete American turpentine is very often sold under this name. It is used in the composition of stimulating plasters, etc. *Burgundy pitch* is made from it. It is a spontaneous exudation from the tree, hardening by exposure to the air, and generally of a whitish or pinkish color, with a rather agreeable odor and a balsamic taste.

FRANKL, LUDWIG AUGUST, b. Bohemia, 1810; a poet of Jewish descent. He was educated in medicine, but preferred journalism and literature. In 1856, he established a school in Jerusalem, and described the condition of the people in his *Nach Jerusalem*, and *Aus Ægypten*. One of his poems, *Die Universitat*, was the first issued after the abolition of the censorship in Austria, in 1848, and 500,000 copies were sold. His best poetical productions are his epics, *Cristoforo Colombo; Don Juan d'Austria;* and *Der Primator*.

FRANKLAND, Sir CHARLES HENRY, 1716–68; b. India; the son of a governor of the East India company's factory at Bengal. Subsequent to 1741, when he was made collector of the port of Boston, Mass., he fell in love with Agnes Surriage, a servant in a hotel at Marblehead, and she became his mistress and afterwards his wife, a marriage prompted, it was said, by his gratitude to her for saving his life in the time of the earthquake at Lisbon, Nov. 1, 1755. He was English consul-general at Lisbon two years later. His widow returned to Massachusetts and resided in Hopkinton, but died in England, 1783.

FRANKLIN, a co. in n.w. Alabama, on the Mississippi border, intersected by Big Bear creek; 700 sq.m.; pop. '70, 8,006—1313 colored. The surface is hilly, and for the most part covered with forests; soil fertile, producing cotton and corn. Co. seat, Frankfort.

FRANKLIN, a co. in n.w. Arkansas, on the Arkansas river, crossed by the Little Rock and Fort Smith railroad; 450 sq.m.; pop. '70, 9,627—651 colored. Surface hilly and undulating, with much woodland; soil fertile. Cotton and corn are the chief products. Bituminous coal is found. Co. seat, Ozark.

FRANKLIN, a co. in n.w. Florida, on the gulf of Mexico, including adjoining islands, and intersected by the Appalachicola river; 475 sq.m.; pop. '70, 1256—475 colored. It has a level surface and sandy soil, much of it covered with swamps. The river bottoms are fertile, but there is little cultivation. Co. seat, Appalachicola.

FRANKLIN, a co. in n.e. Georgia, on the border of South Carolina, drained by the upper branches of Broad river; 450 sq.m.; pop. '70, 7,893—1859 colored. Surface uneven, and soil fertile. The chief productions are corn, cotton, and sweet potatoes. Iron is plentiful; and gold has been found, though in very small quantities. Co. seat, Carnesville.

FRANKLIN, a co. in s. Illinois, on Big Muddy river; 420 sq.m.; pop. '70, 12,652. It is well timbered, with generally level surface, and the soil is fertile, producing the ordinary grains, tobacco, butter, etc. Co. seat, Benton.

FRANKLIN, a co. in s.e. Indiana, on Whitewater river; traversed by the Whitewater canal and the Whitewater Valley railroad; 380 sq.m.; pop. '70, 20,223; in '80, 20,502. Surface in some parts hilly, and in others level; soil generally fertile, producing corn, wheat, butter, wool, etc. Co. seat, Brookville.

FRANKLIN, a co. in n. Iowa, drained by Iowa river, and intersected by the Central Iowa railroad; 576 sq.m.; pop. '75, 6,558. The surface is undulating, and the soil fertile, producing corn, wheat, etc. Co. seat, Hampton.

FRANKLIN, a co in e. Kansas, on the Osage river, intersected by the Leavenworth, Lawrence, and Galveston railroad; 576 sq.m.; pop. '78, 12,381. It has an undulating surface, chiefly prairie-land. The soil is fertile, and produces corn, oats, hay, etc. Co. seat, Ottawa.

FRANKLIN, a co. in n. Kentucky, on the Kentucky river (which is navigable), and crossed by the Louisville, Cincinnati, and Lexington railroad; 212 sq.m.; pop. '70, 15,300—4,663 colored. Surface varied, and soil fertile, producing corn, wheat, tobacco, etc. Co. seat, Frankfort, the state capital.

FRANKLIN, a parish in n.e. Louisiana, between the Tensas and Ouchita rivers, intersected by Macon and Bœuf bayous, which are navigable for steam-boats; 500 sq.m.; pop. '70, 5,070—2,044 colored. Surface uneven, and covered to a large extent with forests. Cotton and corn are the chief products. Co. seat, Winnsborough.

FRANKLIN, a co. in n.w. Maine, on the border of Canada, reached by the Androscoggin railroad; 1600 sq.m.; pop. '70, 35,866. The surface is undulating, and in parts hilly, and is largely covered with forests. Chief productions, wheat, corn, oats, potatoes, etc. Co. seat, Farmington.

FRANKLIN, a co. in n.w. Massachusetts, bordering on Vermont; intersected by the Connecticut and Deerfield rivers, and crossed by the Vermont and Massachusetts, and the Connecticut River railroads; 650 sq.m.; pop. '70, 32,635. It has a hilly and in some places mountainous surface, with picturesque scenery. Chief productions, corn, oats, rye, potatoes, hay, butter, wool, tobacco, and maple sugar. Co. seat, Greenfield.

FRANKLIN, a co. in s.w. Mississippi, on the Homochitto river; 540 sq.m.; pop. '70, 7,498—3,800 colored. It has an uneven surface, fertile in the vicinity of the rivers, but otherwise barren. The chief productions are corn and cotton. Co. seat, Meadville.

FRANKLIN, a co. in e. Missouri, bounded on the n. by Missouri river, intersected by the St. Louis and San Francisco, and the Missouri Pacific railroads; 874 sq.m.; pop. '70, 30,098—2,173 colored. The surface is uneven and well timbered; chief productions, wheat, corn, oats, butter, wine, and tobacco. It abounds with rich mines of lead, copper, and coal. Co. seat, Union.

FRANKLIN, a co. in s. Nebraska, on the Kansas border, intersected by Republican river; 576 sq.m.; pop. '76, 1953. It has a prairie surface and fertile soil, yielding excellent pasturage. Co. seat, Bloomington.

FRANKLIN, a co. in n.e. New York, on the Canada border, intersected by the Ogdensburg and Champlain railroad, and drained by the Racket, St. Regis, Saranac, and Salmon rivers; 1718 sq.m.; pop. '75, 30,822; in '80, 36,601. At the n.w. corner the co. is just touched by the St. Lawrence river. It has many lakes, ponds, and small streams, and is greatly diversified by hills, valleys, and mountains. The n. part is level, while the s. is partly occupied by the Adirondack mountains. Most of the surface is covered with forests of pine, hemlock, cedar, oak, ash, sugar maple, etc. There are manufactures of flour, iron, lumber, and leather. The soil is fertile and well adapted for pasturage. Chief productions, hay, butter, oats, potatoes, hops, and maple sugar. Co. seat, Malone.

FRANKLIN, a co. in n. North Carolina, intersected by Tar river, and traversed by the Raleigh and Gaston railroad; 450 sq.m.; pop. '70, 14,134—7,501 colored. It has a level and fertile soil; cotton, corn, and pork are the chief productions. Co. seat, Louisburg.

FRANKLIN, a co. in central Ohio, on the Scioto and Olentangy rivers, intersected by eight or more railroads, which center at the co. seat, Columbus, the capital of the state; 530 sq.m.; pop. '70, 63,019. The surface is generally level, and there are forests of oak, sugar maple, beech, ash, etc. The soil is fertile, producing corn, wheat, oats, hay, butter, etc. The Ohio canal passes through the s.e. part.

FRANKLIN, a co. in s. Pennsylvania, on the Maryland border, bounded on the n.w. by Tuscarora or Cove mountains, and intersected by the Cumberland valley railroad; 740 sq.m.; pop. '70, 45,365. The surface is rough in parts. Iron ore and slate are found. The chief productions are corn, oats, hay, butter, and pork. Co. seat, Chambersburg.

FRANKLIN, a co. in s. Tennessee, on the Alabama border; intersected by Elk river and the Nashville and Chattanooga railroad; 780 sq.m.; pop. '70, 14,970—2,972 colored. The s.e. portion, which embraces a portion of Cumberland mountains, is hilly, but the other sections are level. Chief productions, wheat, corn, butter, and cotton. Co. seat, Winchester.

FRANKLIN, a co. in n.w. Vermont, on lake Champlain and the Canada border, drained by Lamoille and Missisquoi rivers, and traversed by the Vermont Central, and Portland and Ogdensburg railroads, with steamboat navigation by way of the lake;

630 sq.m.; pop. '70, 30,291; in '80, 30,225. The surface is broken, and the soil fertile. Chief productions, wheat, corn, oats, hay, cheese, butter, maple sugar, and wool. Co. seat, St. Albans.

FRANKLIN, a co. in s.w. Virginia, between Staunton river and the Blue ridge, intersected by Blackwater river; 864 sq.m.; pop. '70, 18,264—5,996 colored. Iron is to be there found. The surface is uneven, and the soil fertile, producing wheat, corn, tobacco, butter, etc. Co. seat, Rocky Mount.

FRANKLIN, a city in Johnson co., Ind., the co. seat, on the Jeffersonville, Madison and Indianapolis, and the Cincinnati and Martinsville railroad, 20 m. s. of Indianapolis; pop. '70, 2,707. It is the seat of Franklin college (Baptist), and possesses several high schools and public halls, and a number of manufactories.

FRANKLIN, the capital of St. Mary's parish, La., on Bayou Teche, 30 m. w. of Brashear City, and about 100 m. from New Orleans; pop. '70, 1265—503 colored. The bayou is navigable for large steamers; and the town has a large trade in exporting cotton, fruits, etc.

FRANKLIN, a city in Venango co., Penn., on the Alleghany river, at the junction of French creek, reached by the Alleghany Valley, the Franklin branch of the Atlantic and Great Western, the Jamestown and Franklin, and the Lake Shore and Southern Michigan railroads, 129 m. by rail n. of Pittsburg; pop. '70, 3,908. It has a court-house, and several manufactories. The chief business is the trade in petroleum.

FRANKLIN, a t. in Williamson co., Tenn., on the Harpeth river, and the Louisville and Great Southern railroad; 18 m. s. of Nashville; pop. '70, 1552. Among its institutions are the Tennessee college for women, and the Harpeth seminary; it possesses several flouring mills and other manufactories.

FRANKLIN. The F., or, according to the old spelling, the frankelein, was the English freeholder of former times, who held his lands of the crown, free (frank) from any feudal servitude to a subject-superior. Chaucer's *Franklin's Tale*, and still more his description of the F. in the prologue to his immortal Pilgrimage, have rendered him a classical character. In the whole circle of our literature there is probably no more perfect picture of the person, habits, and surroundings of a jovial old country gentleman. His beard was white as a daisy, his complexion sanguine, he loved a "sop in wine," and woe to his cook if his sauce were not poignant and sharp; in a word, "he was Epicurus' owen son." But the F.'s luxuries were not intended for his own enjoyment alone, for "a householder, and that a great, was he." His table stood "in his hall alway," "ready covered all the longe day;" and

> Withouten baked meat never was his house,
> Of fish and flesh, and that so plenteous,
> *It snowed in his house of meat and drink.*

Nor was it only in dispensing good cheer that the F. fulfilled the functions of the country gentleman of his day. At sessions, he was "lord and sire," and full often time he had been "knight of the shire." He had been sheriff too, and a contour and vavasour; though what these latter offices were, is a subject of controversy amongst the commentators. "The dress of the F., according to the duke of Sutherland's MS.," says Mr. Saunders, in his excellent little book called *Cabinet Pictures of English Life* (p. 204), was a surcoat of red lined with blue, with bars or stripes of fringe or lace over it. He wore a small blue hat turned up, and black boots." Chaucer adds to his attire a knife or dagger called an "anelace," and a "gipciere" or silk purse, "white as morrow [morning] milk," at his girdle. Mr. Saunders mentions (*ut sup.*) that in the Metrical Chronicle of Robert de Brune, the F. of an earlier period (13th c.) is ranked immediately after earls, barons, and lords, and was evidently a person of great consideration. Such, as we have seen, was very much his position in Chaucer's time, but he seems to have fallen in dignity, and we find him in much lower company in Shakespeare's day. In *The Winter's Tale* the clown is made to say (act v. scene 2):

> Not swear it, now I am a gentleman
> Let boors and franklins say it, I'll swear it.

From other passages it would seem that his position had come to correspond to that of the well-to-do yeoman. In 1 Henry IV., act ii. scene 1, we hear of a F. "in the woald of Kent hath brought three hundred marks with him in gold;" and "Cymbeline" says (act iii. scene 2), "Provide me presently a riding suit, no costlier than is fit a franklin's housewife." There seems no reason to think, however, that Dr. Johnson's remark that F. is "not improperly Englished a gentleman servant," is warranted by his position at any period, and it certainly is not by the passage which he quotes from the *Fairy Queen:*

> A spacious court they see, etc.,
> Where them does meet a franklin fair and free.

FRANKLIN, BATTLE OF, Nov. 30, 1864, between the union forces under gen. Schofield, and the confederates under gen. Hood. Gen. Sherman was in n. Georgia about to begin his march to the sea. In order to force him to turn back, the confederates resolved to invade Tennessee, and early in Oct., Hood with 40,000 men undertook the work. Finding it difficult to maintain his long lines of communication (from Atlanta

to Nashville), Sherman sent Thomas to the latter place, abandoned his lines and started on the famous march to the Atlantic coast. Hood made several attacks upon the union forces with the ultimate purpose of seizing Nashville. At Franklin, Schofield was compelled to make a decisive stand. Gen. Grant, speaking of Hood's tactics, says: "Hood, instead of following Sherman, continued his march northward, which seemed to me to be leading to his certain doom. At all events, had I had the power to command both armies, I should not have changed the orders under which he seemed to be acting." The confederates renewed the attack four several times, but without success, and at midnight, Schofield, meeting with little opposition, retired to Nashville. In this action the confederate loss was estimated at 6,000, the union loss at 2,376.

FRANKLIN, BENJAMIN, a distinguished American statesman and natural philosopher, was b. at Boston, Jan. 17, 1706. His parents were poor, and had a family of 17 children, he being the 15th. Josiah Franklin, his father, had left England in 1685, and settled in America, where he followed the business of soap-boiler and tallow chandler. An the age of 8, F. was sent to school, where he displayed great aptitude for learning. At 12, he was apprenticed to his step-brother James, who had set up a printing-shop in the place, and he soon acquired considerable proficiency at that trade. He was passionately fond of reading, and all the time he could spare, he devoted to the perusal of such books as he could lay his hands on. He early attempted poetry, and when, in 1720, his brother started a newspaper, he contributed a number of anonymous articles to it; but on the fact being discovered, his brother treated him very harshly. After one of the frequent quarrels with his brother he determined to quit him; and accordingly, without the knowledge of his family, he left Boston and proceeded to New York; but not finding employment there, he went next to Philadelphia, where he succeeded in procuring a situation in a printer's shop. Here he attracted the attention of sir William Keith, the governor of Pennsylvania, who advised him to set up a printing establishment of his own. Thinking this good advice, he set out for England, with a view to obtain the necessary plant. Finding himself, however, deceived in his expectations of assistance from Keith, and having no resources of his own, he was compelled to take employment in London, where he resided for about a year. On his way back to Philadelphia in 1726, he made the acquaintance of a merchant named Denham, who gave him the situation of book-keeper in his office; but Denham dying soon after, F. went back to his old trade, and, with the assistance of some friends, started in business for himself. In 1730, he married a Miss Read, with whom he had become acquainted previous to his visit to England. Matters now prospered with F.; he became the proprietor and editor of a newspaper (*The Gazette*) which attained a high degree of popularity, and projected in 1732 *Poor Richard's Almanac*, in which appeared the well-known maxims afterwards published under the title of *The Way to Wealth*, and translated into various languages. Through the instrumentality of F., a public library was founded in 1732, the first established in Philadelphia. He also founded, in 1738, the first association for extinguishing fires, and at a later period the first company for insurance against fire; and in many other ways he contributed to the social and material progress of the city of his adoption. Among the public offices to which he was appointed were those of clerk to the general assembly of Pennsylvania in 1736; postmaster of Philadelphia in 1737; representative of Philadelphia in the assembly in 1747. In 1753, he was appointed deputy postmaster-general for the British colonies. In 1757, he was sent to England to settle some matters for the assembly, and so ably did he perform his task, that Massachusetts, Maryland, and Georgia severally appointed him their English agent. Notwithstanding the multiplicity of his public duties, he found leisure to pursue his scientific investigations with such success as to gain for himself a lasting name in the world of science, as well as to merit the gratitude of the community in general. In 1752, he discovered the identity of electricity with lightning, and turned his discovery to account by publishing a plan for defending houses from lightning by the use of pointed conductors. He likewise made important discoveries with regard to the laws that regulate the electric fluid, a subject hitherto very imperfectly understood. His renown was spread over the whole civilized world, and honors were heaped upon him by the various learned societies of Europe. The Godfrey Coley gold medal was bestowed upon him by the royal society of London, which also nominated him one of its members. The universities of Oxford, St. Andrews, and Edinburgh respectively conferred upon him the degree of D.C.L. He was made an associate of the academy of sciences at Paris, as Leibnitz and Newton had been before him.

During his residence in England he became intimate with some of the most distinguished men both of Britain and of the continent; his correspondence with them indicates the combination in a remarkable degree of a cultivated mind with a vivid imagination. In 1762, he returned to America; but new difficulties arising between the mother country and the colonies, which determined the assembly to demand the establishment of a central government, he was again dispatched to England as its agent. He strongly opposed the stamp act, and was examined at the bar of the house of commons in 1766, when the repeal of that offensive measure was proposed. In consequence of the position he assumed on this occasion, he was deprived of the postmastership, and treated very harshly by the ministry. Despairing of bringing about any reconciliation

between the disputants, he returned to Philadelphia in 1775, where the congress was at that time assembled. He was elected a delegate to it; and from that time he exerted himself to the utmost to obtain a declaration of the independence of the 13 American states. This declaration was pronounced by congress on the 4th July, 1776, and F. was appointed United States minister at the court of France, where he succeeded in inducing the French government to form an offensive and defensive alliance with the states. On the 20th of Jan., 1782, F. had the supreme satisfaction of signing at Paris, along with the English commissioners, the treaty of peace by which the independence of the American colonies was assured. Returning to America in 1785, he was successively chosen member and president of the supreme executive council for the city of Philadelphia, and in 1787, delegate for Pennsylvania to the convention for the revision and emendation of the articles of union. In 1788, he retired from public life, and died April 17, 1790, at the advanced age of 84. The congress, as a testimony of the gratitude of the 13 states, and of their sorrow for his loss, appointed a general mourning throughout the states for the period of two months.

F., in all his labors, was ever actuated by an intense desire to promote the well-being and happiness of his fellow-men; and few have been more successful in their aims. From poverty he rose to wealth, and from ignorance and obscurity to extensive erudition and honorable renown; gaining for himself the admiration of Europe and the gratitude of America.

In person, F. was about 5 ft. 9 or 10 in. in height, and well and strongly made. He had a fair complexion and gray eyes, while his manners were extremely winning and affable. None of his descendants bears his name; the last who did so being his grandson, William Temple Franklin, who died in 1823. There are many descendants of his daughter, who married a Mr. Bache.

The works of F. appeared in London in 1806. His memoirs, etc., were published in 1817; a complete edition of his works, in 1836–40. In 1874, Bigelow published a new edition of F.'s autobiography (originally published in a French translation), from the original autograph. See Parton's *Life and Times of F.*, 1864.

FRANKLIN, Benjamin (*ante*), philosopher and statesman, b. Boston, Mass., Jan. 17, 1706; d. Philadelphia, April 17, 1790. His father, Josiah Franklin, an English dyer and chandler, emigrated to America, with his family, in 1682. His mother, a second wife, was the daughter of Peter Folger, a leading citizen of Nantucket. Benjamin Franklin was the fifteenth of seventeen children, and his father intended him to enter the ministry, but was compelled by narrow circumstances to take him from school when ten years old, and in his twelfth year he became an apprentice with his older brother, a printer, founder of the *New England Courant*. He was passionately fond of reading, and contributed anonymously some articles to his brother's paper. The paper was condemned for its political leanings by the general court, and the elder brother imprisoned for a month. The paper being interdicted in his brother's name, Franklin undertook to issue it in his own name; but difficulty with his brother led him at last to leave Boston clandestinely, taking passage on a sailing-vessel to New York; and finding no work there, he went to Philadelphia, where he arrived without friends, and almost destitute. He was only 17 years old, and obtained employment with a printer named Keimer, and found a lodging in the house of his future father-in-law. By some published letters he attracted the notice of sir William Keith, governor of the province, who promised him the government printing, and the following year induced him to go to England to purchase stock for a new printing office; but when arrived in London, Franklin found himself without the governor's promised help, and was obliged to take service with a printer named Palmer to meet his daily necessities. During a stay of a year and a half in London, he published a pamphlet on *Liberty and Necessity, Pleasure and Pain*, advocating views which he afterwards repudiated as crude and immature. It gained him the notice, however, of Dr. Mandeville and other men of note. In 1726, he returned to Philadelphia with a Mr. Denham, who was founding a dry-goods shop in that city, with whom he was employed as a clerk. Subsequently he worked for his former employer, Keimer, whom he assisted in printing bank-notes in New Jersey, constructing for this purpose a copper-plate press, said to have been the first of its kind in America. He founded, with a fellow-workman, a new printing office, and was married, in 1730, to Miss Deborah Read. He founded, about this time, the *Pennsylvania Gazette*, and rapidly rose to competence and public consideration. He started, in 1731, the "Philadelphia Library," chartered in 1742, "the mother of American libraries," and in 1732, first published his almanac, under the pseudonym of Richard Saunders, which, known as *Poor Richard's Almanac*, was continued for 25 years. After a short visit to his relatives in Boston, he was chosen clerk of the general assembly in 1736, and postmaster of Philadelphia in 1737. In 1743, he planned an academy, which was successfully established six years later and became the foundation of the university of Pennsylvania. In 1744, he organized a scientific society, which became the American philosophical society, and subsequently the American academy of sciences. About this time he invented the open stove which bears his name, and began those investigations in electricity which have ranked his name with great discoverers. His views, though novel, were at length universally accepted, and he was elected F.R.S., and, in 1762, received the degree of LL.D. from the universities of Oxford, St. Andrews, and Edinburgh, and in 1775, the Copley gold medal.

In 1753, he was appointed deputy postmaster-general of the colonies. He was active and influential in the measures for the public defense on the approach of the French and Indian war. He was a commissioner from Pennsylvania at the congress in Albany, 1754, and submitted a plan for a union of all the colonies under one government. His plan was rejected, being criticised in America as containing too much "prerogative," while in England it was thought too "democratic." Franklin maintained that these diverse criticisms showed his plan to be the true mean in which safety would be found. War having actually come, he served effectively in gathering supplies and arranging transportation for Braddock's campaign, subscribing £1000 from his private means.

In the Pennsylvania assembly, he was a recognized defender of colonial interests against the over-exactions of the proprietaries. In 1764, the assembly sent him as its commissioner to England, and other colonies united in intrusting to him their interests. Through his representations the stamp act was repealed in 1766. He earnestly labored to avert the revolution, but, feeling it inevitable, returned to America in the spring of 1775.

He was at once chosen to the continental congress, and was one of the committee to draw up the declaration of independence, of which he was also one of the signers.

During the war of American independence, he represented American interests in Europe, particularly in France, where he was associated as a commissioner with Silas Deane and Arthur Lee. His scientific reputation as well as his dignity of character and practical wisdom, gave him influential access to the leading minds in France, and he powerfully contributed to secure for his country French recognition and material aid. Though not received officially at first, after the news of the defeat of Burgoyne he concluded a treaty, Feb. 6, 1778. He was now made minister plenipotentiary to the French king. He signed the preliminary articles of peace at Paris, Nov. 30, 1782, and the definitive treaty, Sept. 3, 1783. He afterward secured a treaty with Prussia, in which he inserted an article against privateering.

On his return, in Sept., 1785, to America, he was appointed a member of the executive council of Philadelphia, and soon after president of the state. In 1787, he was a member of the convention to form a national constitution. He was then 82 years of age, but was efficiently active in the business of the convention. He was deeply interested in all schemes of usefulness and philanthropy, and one of his last public acts was to sign a memorial to congress as president of the Pennsylvania society for the abolition of slavery.

Upon his death, resolutions of mourning were passed by congress, and the national assembly of France, on the motion of Mirabeau, put on mourning for three days.

Franklin was the first American citizen to win European fame. His leading characteristics were common sense, sagacity, and practical wisdom, with industry, tact, and indomitable firmness in the management of affairs, whether small or great. With these was joined a keen, close observation, and painstaking care. Frugal, and regardful of his own interests, he was eminent in public spirit and patriotic devotion. In imagination and all that connects man with the infinite, he was singularly deficient. He brought all things to the test of practical utility. Yet injustice has been done him by exclusive emphasis of this quality. The influence of Shaftesbury made him a skeptic for a short time during his youth, but his most conspicuous act in the constitutional convention of 1787 was his motion that its sessions be opened with prayer. As a statesman and diplomatist, he carried into the high sphere of national policy that same devotion to truth for its own sake, and the practical wisdom, which gave success to his private undertakings. Turgot's felicitous epigram expresses the world's esteem of Benjamin Franklin: "*Eripuit cœlo fulmen sceptrumque tyrannis.*"

FRANKLIN, Lady Jane, the second wife of sir John F., to whose unwearied energy, devotion, and hopefulness, when hope had sunk in all other hearts, we are indebted for the knowledge of the fate of her gallant husband, was the daughter of John Griffen, esq., of Bedford place, London, and was married to sir John F. in Nov., 1826. In 1848, when, owing to the long absence of news about the expedition of the *Erebus* and *Terror*, fears began to be entertained about its safety, lady F. offered large rewards to any persons who should discover and relieve the missing voyagers, or who would make exertions with that end in view. From that time until 1857, when she fitted out the *Fox*, under McClintock, whose discoveries set all doubts about the fate of her husband's expedition at rest, lady F. never rested in her efforts to incite by voice, pen, and purse, her own countrymen and Americans, to search for the missing ships. Her interest in Arctic exploration never flagged up to her last illness and death in 1875.

FRANKLIN, Rear-admiral Sir John, an English naval officer of distinguished reputation, was b. at Spilsby, in Lincolnshire, April 16, 1786. He was descended from a long line of freeholders, and was the youngest son of a respectable yeoman. F. received the rudiments of his education at St. Ives; afterwards he spent two years at the grammar school of Louth. It is stated that he was intended for the church, but as he displayed a decided predilection for the sea, his father wisely abandoned opposition to his choice of a profession, and procured him, in 1800, a midshipman's post on board the *Polyphemus* line-of-battle ship. In the following year, F.'s ship led the van in the desperate battle of Copenhagen. Two months after, he was removed to the *Investigator*, then fit-

ting out under command of capt. Flinders, for discovery and survey of the Australian coast. In this expedition, F. had the companionship of the distinguished botanist Robert Brown, and of his coadjutor Ferdinand Bauer, and from them he learned the great importance of the natural sciences, in the promotion of which he ever afterwards took a deep and intelligent interest. On his return to England, F. was appointed to the *Bellerophon*, in which he acted as signal midshipman in the battle of Trafalgar (1805), and had the good-fortune to escape unhurt. He subsequently served in the *Bedford* on various stations, and took a distinguished part in the attack on New Orleans in 1814. In 1819, F. was despatched by government to Hudson's bay, with orders to make his way thence to the Arctic sea, and survey as much of the coast as possible. In the course of this expedition, which lasted about three years and a half, F. traveled 5,550 miles under circumstances of the greatest hardship and privation, to which more than half of his companions succumbed. But the gain to science was great, alike from the carefulness and extent of the physical surveys of the mouth of the Coppermine river, and eastward along Coronation gulf, and from the attention devoted to the natural productions of these inclement shores. On his return, in 1822, F. was made post-captain, and elected a fellow of the royal society. In 1825, he co-operated (overland) with the sea-expeditions of capts. Parry and Beechey, and surveyed the North American coast from the mouth of the Coppermine westward to about Point Beechey. F.'s discoveries now extended over 44 degrees of longitude, or more than a third of the distance between Baffin's bay and Behring's strait. For these valuable explorations, in which he was engaged until 1827, he received the honor of knighthood from his sovereign, and the degree of D.C.L. from the university of Oxford, while the French geographical society awarded him their gold medal, and at a subsequent period he was elected corresponding member of the institute of France. F. next took an active part in the Greek war of liberation. In 1836, he was appointed governor of Van Diemen's Land, where his wise and moderate conduct secured for him the warm approbation both of the government and the colonists. The latter established a college and a philosophical society in his honor; and years after, they testified that the memory of his rule was still gratefully cherished, by subscribing £1600 towards an expedition designed for his rescue. In May, 1845, F., now bordering on his 60th year, but with physical and mental powers undiminished in vigor, started with the *Erebus* and *Terror* on his last and ill-fated expedition to discover the North-west passage. The last time that the vessels were seen was in July of the same year. To enter into the history of the efforts undertaken for the relief or discovery of the fate of F. would be out of place here. It is sufficient to say, that in the course of eleven years upwards of twenty separate expeditions, at the cost of about a million sterling, were sent out to look for the missing crews; and the discoveries of these expeditions added more to our knowledge of the arctic regions than all previous explorations had done. See NORTH-WEST PASSAGE. It was not until 1859 that the fate of F. was ascertained by the commander of a little vessel fitted out by lady Franklin, after hope had been declared hopeless by all else. It then appeared that F. had died on the 11th June, 1847, fortunately before his sympathetic heart had been lacerated by witnessing the awful sufferings of his men. F. was one of the boldest and most persevering explorers that Britain ever sent from her shores. His daring was qualified by judgment, and his sense of duty and responsibility as to the lives of those under his charge was of the keenest. His heart was tender as a woman's; and altogether he was one of the noblest types of a true Christian gentleman.

FRANKLIN LAKE, in Elko co., Nev., e. of the East Humboldt mountains. It is fresh and shallow, and has no outlet. Reeds flourish there in great quantities.

FRANKLIN, WILLIAM, 1729–1813; b. Philadelphia; a natural son of Benjamin the philosopher, who acknowledged him and brought him up as his own. During the French war, William served in the Pennsylvania line on the Canadian frontier, and became a captain before he was of age. In 1754, he was comptroller of the general post-office, and for a time clerk of the provincial assembly. Going with his father to London, he was there admitted to the bar (1758), and in 1762 was appointed governor of New Jersey. In the revolution he remained loyal to England, and was kept under surveillance by the patriots. He gave his word that he would not leave the province; but in consequence of summoning a meeting of the old colonial assembly, he was arrested and sent to Connecticut, and kept a prisoner for two years. In Nov., 1778, he was exchanged and took refuge in New York. A year before peace he went to England, where he died. His political course estranged his father, to whom it was the cause of much sorrow.

FRANKLIN, WILLIAM BUEL, b. Penn., 1823; a graduate of West Point; joined the topographical engineers; served on gen. Wool's staff in the Mexican war; was acting professor of natural and experimental philosophy at West Point; professor in the New York free academy, and on engineering duty in various places for the government. In the war of the rebellion he served on the side of the union in many capacities, rising to maj.gen. of volunteers. In 1866, he resigned and went into private business.

FRANKLINITE, a mineral consisting of oxide of manganese, oxide of zinc, and peroxide of iron, in the proportions severally of about 16, 17, and 66. It is found in

considerable quantity in n. New Jersey, in large veins or beds in mines of zinc lying between the crystalline limestone and the gneiss rocks. Its specific gravity is from 5 to 5.09, and its hardness from 5.5 to 6.5. Franklinite is especially useful for making Bessemer steel.

FRANKMARRIAGE (*liberum maritagium*) was a species of estate tail existing by the common law of England: for where a man, on the marriage of his daughter or cousin, gave lands to be held in F., this implied a gift in special tail, to the donees and heirs of their bodies. This tenure was called *liberum maritagium*, to distinguish it from other species of estates tail (*Co. Litt.* 94 b). Four things were necessary to a gift in F.: 1 That it must be in consideration of a marriage, but it might be as well after as before a marriage. 2. That the donee with whom it is given be of the blood of the donor. 3. That the donees should hold of the donor. Hence a gift in F. by a subject became impossible after the statute of *quia emptores.* 4. That the donees should hold for four generations. Therefore a gift in F. with a reservation of a remainder to a stranger, or a devise by will, was bad.

FRANK-PLEDGE, a law prevailing in England before the Norman conquest, whereby the members of every tithing were responsible for the good conduct of each other. This responsibility, according to Mr. Hallam, consisted in every 10 men in a village being answerable each for the others, so that if one committed an offense, the other nine were liable for his appearance to make reparation. Should the offender abscond, the tithing, if unable to clear themselves from participation in the crime, were compelled to make good the penalty. This law has been ascribed to Alfred the great; but it would appear to have been in existence at a much earlier period. Mr. Hallam, *Middle Ages*, ii. p. 80 (edit. 1841), observes: "The peculiar system of frank-pledges seems to have passed through the following very gradual stages. At first, an accused person was bound to find bail for standing his trial. At a subsequent period, his relations were called upon to become securities for payment of the compensation and other fines to which he was liable; they were even subject to be imprisoned until payment was made, and this imprisonment was commutable for a certain sum in money. The next usage was to make people already convicted, or of suspicious repute, give securities for their good behavior. It is not till the reign of Edgar that we find the first general law, which places every man in the condition of the guilty or suspected, and compels him to find a surety who shall be responsible for his appearance when judicially summoned. This is perpetually repeated and enforced in later statutes during his reign and that of Ethelred. Finally, the laws of Canute declare the necessity of belonging to some hundred and tithing, as well as of providing sureties."

The *court of frank-pledge*, or *court-leet*, is a court of record held once in the year, and not oftener, within a particular hundred, lordship, or manor, before the steward of the leet; being the king's court granted by charter to the lords of those hundreds or manors. All freeholders resident in the jurisdiction are bound to attend this court; but persons under 12 and over 60 years of age are excused, and by the statute of Marlbridge, 52 Hen. III. c. 10, all prelates, peers, and clergymen, and women are discharged from attendance. It was also the custom to summon all the king's subjects to this court, on attaining years of discretion, to take the oath of allegiance. The business of this court was to present by jury all crimes committed within their jurisdiction, and to punish all trivial misdemeanors. This court has practically fallen into desuetude, and the business is discharged by the justices of the peace at general and petty sessions. See Blackstone's *Commentaries*. Originally, the business of the court of frank-pledge was confined to the taking securities or free pledges for every person within the jurisdiction; but this practice having fallen into disuse, the court gradually acquired a criminal jurisdiction, concurrent with that of the sheriff's tourn. "*Magna Charta* distinguishes between the tourns or leets of sheriffs and the view of frank-pledge; limiting the former to twice a year, and the latter to once. In the more ordinary sense, frank-pledge and leet are synonymous, as appears from the style of tourns and other leets, which in court-rolls are usually denominated *curiæ* or *nisus franci plegii.* But when free pledge is used, as in Magna Charta, it should be understood in a strict and particular sense."—*Co. Litt.* by Hargrave, 115 a, note 10.

FRANKS (i.e., freemen) was the name assumed by a confederation of German tribes that appeared on the Lower Rhine in the 3d c., and afterwards overthrew the Roman dominion in Gaul. It was only the name, however, that was new; the individual tribes composing the confederation had been known on the Rhine as early as the time of Augustus. The most important of these were the Sigambri, Chamavi, Ampsivarii, Chatti, Chattuarii, and Bructeri of the time of the first emperors. In the 3d and 4th centuries hordes of them began to pour through the Low Countries into Gaul, until at last the country became their prey. After the middle of the 4th c., they appear divided into two groups, the Salians—either from the old Ger. *Sal*, or the river Sala (*Yssel*)—and the Ripuarians (*ripa*, the bank), the first inhabiting Holland and the Low Countries, the last on both sides of the Rhine as far up as the Main. Each group had its own laws, afterwards committed to writing (*Lex Salica* and *Lex Ripuariorum*). Like the two peoples, these laws differ little even in detail. The F. were a mobile, well-endowed race, forming in language and art the transition from the Low Germans to the High; and they

compose to this day the ground of the population of the w. of Germany as far as the Neckar, Main, Murg, and Lower Alsace, as well as the chief Germanic element of the population of northern France. For the later history of the F., see articles CLOVIS, CARLOVINGIANS, CHARLEMAGNE, FRANCE, MEROVINGIANS, etc.

FRANZ, ROBERT, b. 1815; a German composer, for the most part self-educated. He was assisted in the publication of his first songs by Schuman, and his works are ranked second only to those of his patron. He has written hundreds of songs, and many accompaniments to works of the old masters. He is entirely blind.

FRANZENSBRUNN, or FRANZENSBAD, a small village and well-known bathing-place in Austria, on the north-western frontier of Bohemia, 3 m. n.w. of Eger, is situated amid low bare hills, and consists of four rectangular streets lined with trees. It has four cold mineral springs, chiefly of alkalo-saline chalybeate water, deemed highly efficacious in the cure of scrofulous complaints and diseases of the skin, and used principally for drinking, but also for bathing purposes, in which case the water is heated to a temperature of 90° to 98° F. Nearly 200,000 bottles of these waters are exported annually. F. has also mud and gas baths.

FRASCA'TI, a beautiful t. about 8 m. e.s.e. of Rome, with a pop. of 7,000. It stands on the lower heights of the Alban hills, not far from the site of ancient Tusculum, which was built on a higher range of hills. Tusculum (q.v.), a town of much more ancient date than Rome, was burned and ruined by the Romans in 1191 A.D., to avenge a former victory gained by the Tusculans in 1167. Those of the inhabitants who escaped the fury of the conquerors, sought refuge on the slope of the hill towards Rome, constructing small huts out of the underwood or *frasche*, and hence the modern name Frascati. The chief attractions of F. are its lovely villas and salubrious air, which attract from Rome in the hot season all its noble and foreign residents, and render this resort in the Alban hills the most fashionable *villeggiatura* in the vicinity of the eternal city. The most splendid of these summer residences are the villas Aldobrandini, also known as Il Belvedere, from its commanding and noble prospect; those of Mondragon and Taverna of the Borghese family; the villas Pallavicini and Piccolomini.

The cathedral contains a tablet to the cardinal of York, for many years bishop of this diocese, and another to his brother, Charles Edward, the young pretender, who died here in 1788.

FRASER, ALEXANDER CAMPBELL, b. Scotland, 1819; educated in Edinburgh, where he was lecturer on mental philosophy in the new college. From 1850 to 1857, he edited the *North British Review*, in the latter year succeeding sir William Hamilton as professor of logic and metaphysics in the university of Edinburgh. Among his publications are *Essays in Philosophy; Rational Philosophy;* and two works concerning the life, etc., of bishop Berkeley.

FRASER, CHARLES, 1782–1860; b. S. C.; an American artist. He began sketching when but 12 years old; afterwards studied law, then art, and again law, and was admitted to the bar in 1807. After about 10 years' practice, he gave up law and returned to art, devoting himself chiefly to portrait painting. A collection of 450 of his works was exhibited in Charleston in 1857. He wrote *Reminiscences of Charleston*, and many poems and addresses.

FRASER, SIMON. See LOVAT, LORD.

FRASER RIVER, the principal stream of British Columbia, comprises in its basin the far greater part of the colony. The F. R. proper has its origin in the union of two branches, the more important of which receives its waters from a series of lakes that lie in lat. 54° to 55° n., long. about 124° 50′ w., flows in a general s.e. direction for 260 m., and then unites with the other branch, which has its source near mount Brown, in the Rocky mountains, lat. 58° n., long. 118° 40′ w., flows n.w., and is 200 m. in length. The point of confluence is near fort George, in lat. about 53° 25′ n., and in long about 122° 40′ w., and hence the F. R. flows in a generally southern direction through nearly the whole length of the colony, and after a total course of 740 m. it falls into the gulf of Georgia between Vancouver's island and the mainland, barely to the n. of the international boundary of 49° of latitude. Its chief affluents are the Stuart and the Chilcotin on the right, and the Thompson on the left. Between the Stuart and the Chilcotin, and on the same side, the F. R. is joined by an affluent, which is rather of historical interest than of physical importance—the West Road river, which took its name from its having been ascended by sir Alexander Mackenzie, on his adventurous journey of 1793 from the Hudson's bay territories to the Pacific ocean. The F. R. is practicable for steam-boats as far up as fort Hope, a distance of about 150 m. from its mouth, while about half that distance, as far as New Westminster, it is navigable for large ships. Above fort Hope, all intercourse is more safely and conveniently conducted by land; and even the aborigines, as their trails still testify, appear to have yielded to the same necessity.

In 1857, the F. R., in its auriferous diggings and washings, began to stand forth as the rival of California and Australia. Since then, the discoveries, originally confined to the lower basin, have steadily become at once more extensive and more productive.

Eastward on the Thompson, and more especially northward among the upper waters of the great artery of the country, the precious deposit has sometimes given almost fabulous returns. The mining operations here are, however, almost wholly in the hands of Chinese and Indians. It was estimated that during the year 1875 they secured gold to the amount of 50,000 dollars (over £10,000). Specimens of silver have also been found on the F. R., so rich as to justify the construction of extensive works. Happily for the country, the days of easy gains and wicked waste have passed away. Since 1862, washings and surface diggings have been succeeded by systematic mining and steady labor. The F. R., its tributaries, and the numerous lakes communicating with them, furnish great facilities for the transport of timber. The lower Fraser country is especially densely wooded. A steamer runs as far up the river as Yale. The salmon of the F. R., of which there are five species, are justly famous.

FRA'SERA, a genus of plants of the natural order *gentianeæ*, with a 4-partite calyx and corolla, 4 stamens, and a 2-valvular capsule. *F. Walteri*, a native of Carolina, Virginia, and great part of the basins of the Ohio and Mississippi, is often called American calumba, the root being imported into Europe under that name. It is a pure and valuable bitter, similar in its effects to gentian. The stem is herbaceous, erect, 3 to 6 ft. high; the leaves oval, oblong, opposite, and whorled; the flowers greenish yellow. The plant is a biennial. It grows in marshy places.

FRA'SERBURGH, a burgh of barony and regality and seaport on the n. coast of Aberdeenshire, 42 m. n. of Aberdeen. It stands on the n.w. side of a bay 2 m. in depth immediately south of Kinnaird's head (supposed to be the *Taixalorum Promontorium* of the Romans), on which is the wine tower, an old castle with a cave below. The town, originally called Faithly, was made a burgh of barony by queen Mary in 1546. Its name was changed into Fraserburgh (in honor of its proprietor, sir Alexander Fraser of Philorth) by king James VI. in 1592; and the same king, in 1601, erected it into a free port, free burgh of barony, and free regality. The streets are wide and clean, with substantial houses. Pop. in 1871, 4,252, annually increased by 1200 during the herring fishing in July and Aug. It is possessed of one of the best harbors on the e. coast, which has lately been greatly extended, and has a patent slip attached to it. The chief exports are oats, barley, meal, potatoes, cured herrings, and cod. F. is now one of the most successful herring fishing stations on the e. coast of Scotland, the average number of boats being between 600 and 700. Since 1865, it has been connected with Aberdeen by railway. F. has a handsome cross and town-house in the principal square, and a spacious hall belonging to the harbor commissioners. Sir Alexander Fraser, in 1592, obtained a charter for the establishment of a college and university here, but the plan was never carried out.

FRASIER, a strawberry flower, is used by Scotch heraldic writers as synonymous with a cinquefoil; as in blazoning the coat of the Frasers, *Azure three frases* (Nisbet, i. p. 388).

FRATERCULA. See PUFFIN.

FRATICEL'LIANS, or FRATICELLI ("Little Brethren"), a sect of the middle ages, which may be regarded as an embodiment, outside of the mediæval church, of the same spirit to which is due, within the church, the Franciscan order with its many offshoots. The Italian word *Fraticelli* originally was the popular name of the Franciscan monks; but, in the progress of the disputes which arose in the order (see FRANCISCANS), the name was specially attached to the members of the rigorist party, and eventually to those among them who pertinaciously refused to accept the pontifical explanations of the monastic rule, and, in the end, threw off all subjection to the authority of the church. Several of the popes, especially Gregory IX. and Nicholas III., attempted to reconcile the disputants. Pope Celestine V. granted permission to the rigorists to form for themselves a separate organization, in which the rule of St. Francis might be observed in all its primitive and literal rigor. The suppression of this order by Boniface VIII. appears to have furnished the direct occasion for the secession of the extreme party from the church. They openly resisted the authority of the pope, whom they proclaimed an apostate from the faith. The party thus formed was increased by adhesions from other sectarian bodies, as the "Beghards," and the "Brethren of the Free Spirit" (see FREE SPIRIT). In vain Clement V., in the council of Vienna (1311–12), put forward a new declaration regarding the rule of St. Francis. They still held their ground, especially in Sicily, central and northern Italy, and Provence. John XXII., against whom they sided actively with Lewis of Bavaria, condemned them by a special bull in 1317, and again in a similar document directed against Henry de Ceva, one of their chief leaders in Sicily. From these sources we learn that they regarded the existing church as in a state of apostasy, and claimed for their own community the exclusive title of the church of God. They forbade oaths, and discountenanced marriage. They professed a divine mission for the restoration of the Gospel truth. They held that all spiritual authority was forfeited by sin on the part of the minister. It would even appear that they proceeded so far as to elect for themselves a pope, with a college of cardinals, and a regular hierarchy (Wadding, *Annal. Min. Fratrum ad an.* 1374, n. 20). Their principles, in a word, seem to have partaken largely of the same fanatical and antisocial tendencies

which characterized the Brethren of the Free Spirit; and in common with them, the F. were the object of a rigorous persecution about the middle of the 14th century. The principles of this sect formed the subject of a public discussion at Perugia in 1374 between them and a Franciscan monk named Paolucci, which appears to have ended in their discomfiture. They still maintained themselves, nevertheless, in central Italy, down to the 15th c., when John de Capistran received a commission to labor for their conversion in the march of Acona; but before the beginning of the following century, they seem to have disappeared altogether. See Mosheim, *De Beghardis et Beguinabus* (Lipsiæ, 1790); Milman's *Latin Christianity*, vol. v.; Herzog's *Real-Encyclopädie.*

FRATTA-MAGGIORE, a t. of Italy, 6 m. n.e. of the city of Naples, has extensive rope-works, and furnishes great quantities of strawberries for the market of the capital. Silk-worms are here reared in great quantities. Pop. about 11,000.

FRAUD. By the laws of all civilized nations F. invalidates obligations. In order to produce this effect, however, it is necessary that the misrepresentations, or other dishonest maneuvers of the offending party, shall have induced the other to enter into the agreement or contract, and that he would not otherwise have consented. F. of this description on the one side produces *error in essentialibus* on the other, and where such error exists there is no consent. But as consent is of the essence of the contract, there is here no contract at all; i.e., the contract, or pretended contract, is, as lawyers say, null *ab initio*. It is not necessary that the F. which thus gives birth to the contract shall have consisted in positive misrepresentation, or even in studied concealment; and it was well laid down in the case of an English sale, that where the purchaser labored under a deception, in which the seller permitted him to remain, on a point which he knew to be material in enabling him to form his judgment, the contract was void. But there is another kind of F. which, though it be not actually the cause of, is incident to, the contract, and which, though it does not annul the contract, gives rise to an action for damages or restitution by the party deceived. The distinction between these two kinds of F. was well known to the civilians, the first species being described by them as that "quod causam dedit contractui," that is to say, which causes the contract; the second as that "quod tantum in contractum incidit," which is incident to, or accompanies the contract, but independently of which the contract would have been entered into (Voet. lib. 4, tit. 3, 3). There is another very important element to be taken into account in judging of the character, and determining the legal effects of a F., viz., whether it proceeded from one whose position was such as to impose upon him the obligation of making the discovery. In illustration of this principle, the following case was put by lord Thurlow in Fox *v.* Mackreth (2 Bro. Ch. R. 420): "Suppose that A, knowing there to be a mine on the estate of B, of which he knew B was ignorant, should enter into a contract to purchase the estate of B for the price of the estate, without considering the mine, could the court set it aside? Why not, since B was not apprised of the mine, and A was? Because A, as the buyer, was not obliged, from the nature of the contract, to make the discovery. . . . . . The court will not correct a contract merely because a man of nice honor would not have entered into it; it must fall within some definition of fraud. The rule must be drawn so as not to affect the general transactions of mankind." Neither will the commendations usually bestowed on their commodities by tradesmen be regarded as fraudulent statements, so long as they are simply extravagant in degree; but if positively at variance with facts known to them, they will not be permitted to enjoy the protection which custom has extended to ordinary "puffing." The same principle will yield the converse result wherever a relation of peculiar confidentiality exists between the contracting parties. Here courts of law require what is called *uberrima fides*, the fullest measure of good faith, to validate the transaction. As an illustration, may be mentioned a case in which the managing partner of a firm purchased the share of his copartner for a sum which he knew from the accounts, of which he had the entire superintendence, to be inadequate, but the inadequacy of which he concealed. The transaction was reduced, sir John Leach, V. C., remarking that "the defendant being the partner whose business it was to keep the accounts of the concern, could not in fairness, deal with the plaintiff for his share of the profits of the concern without putting him in possession of all the information which he himself had with respect to the state of the accounts between them."—Maddeford *v.* Austwick, 1 Gim. R. 89.

In addition to direct misrepresentation, and concealment in circumstances in which open dealing was a duty, fraud may be perpetrated by taking advantage of the imbecility of the party who has been led into the contract, and still more flagrantly by inducing this imbecility by intoxication or otherwise. See CONCEALMENT, ERROR, MISREPRESENTATION, CONTRACT. In addition to the ordinary English sources of information, we may refer to the extensive and learned *Traité du Dol et de la Fraude*, par J. Bédarride, 3 vols. (Paris, 1852).

FRAUDS, STATUTE OF. The many provisions of the celebrated English statute appear to fall under the following heads: 1. The creation and transfer of estates in land, both legal and equitable, such as at common law could be effected without deed. 2. Contracts which in certain cases could at common law be validly made by oral agreement. 3. Additional solemnities in case of wills. 4. New liabilities imposed in respect of real estate held in trust. 5. The disposition of estates during life. 6. The entry

and effect of judgments and executions. The first and second heads contain all that in common professional use is meant by the statute of frauds. They present this important feature, characterizing and distinguishing all their minor provisions; that is, that whereas before their enactment the law recognized only two great classes of contracts, etc.—those which were by deed, and those which were by parol, including under the latter term what was written and what was oral—these provisions introduced into the law a distinction between written parol and oral parol transactions, and rendered a writing necessary for the valid performance of the matters to which they relate. These matters are as follows: Conveyances, leases, and surrender of interest in lands; declarations of trusts of interests in lands; special promises by executors or administrators to answer damages out of their own estate; special promises to answer for the debt, default, or miscarriage of another; agreements made upon considerations of marriage; contracts for the sale of lands, tenements, or hereditaments, or any interest in or concerning them; agreements not to be performed within the space of one year from their making; contracts for the sale of goods, wares, and merchandise for the price of £10 or upwards. By the statute all these must be put in writing, and signed by the party charged, or his attorney. In regard to contracts for the sale of goods, wares, and merchandise, the payment of earnest-money or the acceptance and receipt of a portion of the goods dispenses with the written memorandum.

The substance of this English statute so far as regards the provisions referred to has been enacted in nearly all the states of the American union. Some points of law, coming within the same general policy, but not embodied in the original courts of equity, have been made the subject of enactments.

Both law and equity courts come under the provisions of the statute of frauds, although, in exceptional cases, courts of equity have the privilege of granting relief which may not come within the strict reading of the law. Supposing, for example, that a contract which has been only verbal is fully and efficiently detailed in the bill of the plaintiff in equity, it can be enforced, because no fraudulent intention is to be suspected, and besides, the defendant, by neglecting to urge his right of defense under the statute, may be supposed to have wittingly set it on one side.—So, too, in case of an oral contract, if once the undertaking has been commenced, the completion of it will be decreed; that is to say, if the commencement is more than the mere payment of money, it must be something done entirely with the intention of fulfilling the contract.

FRAUDULENT CONVEYANCE. In England the law now declares that unless the property thus conveyed might have been seized in liquidation it does not constitute fraud, no injury accruing to the creditors in such a case. Should the law permit property which cannot be taken in execution to be devoted to the payment of debts by other means, the creditors would be deprived fraudently by its withdrawal from them. Fraudulent intention is not so readily presumed if the injury involved in gratuitous disposition of property affects subsequent creditors injuriously, rather than antecedent creditors. A proof that such a disposition of property has the result of a premeditated intention to incur debts, after the means of paying them had been bestowed upon others, would render the conveyance fraudulent and invalidate it. But unless there were direct evidence to the fact, it would be impossible to conclude, for the mere conveyance of property to a wife, child, or friend, without prejudice to any existing claims, that there had been any fraudulent intent in such a disposition of property.

FRAU'ENBURG, a t. in the district of Konigsberg, Prussia, on the Frische-Haff, at the mouth of the Baude, 41 m. s.w. of Konigsburg; pop. 4,000. It is the seat of the Roman Catholic bishop of Ermeland. Copernicus was once canon of F., and the cathedral contains his tomb. He is said to have constructed the tower containing the machinery for supplying the town and the neighborhood with water.

FRAU'ENFELD, a t. in Switzerland, the capital of the canton Thurgau, in the beautiful and fertile district on the Murg, 23 m. n.e. of Zurich; pop. '70 (with adjoining villages), 5,188. It is the artillery depot of e. Switzerland, and had an old tower of the 10th c., a Capuchin monastery, town-house, armory, and public school. Manufactures of yarn and cloth are among the chief industries. There was a battle here in 1799 between the French and Austrians.

FRAUNHOFER, JOSEPH VON, a distinguished practical optician, was b. at Straubing, in Bavaria, 6th Mar., 1787. In 1799, he was apprenticed to a glass-cutter in Munich, and in 1806 was received, as a working optician, into the establishment of Reichenbach & Utschneider at Benedictbeurn (afterwards, in 1819, removed to Munich). While there, he acquired considerable wealth through his inventions, and soon afterwards became proprietor of the establishment. He invented a machine for polishing parabolic surfaces, and was the first who succeeded in polishing lenses and mirrors without altering their curvature. His prisms also were celebrated, being free from the blebs and striæ which are so often seen in those of English manufacture. His inventions are numerous, and include a "heliometer," a "micrometer," an "achromatic microscope," besides the great parallactic telescope at Dorpat. But that which has rendered F.'s name celebrated throughout the scientific world, is his discovery of the lines in the spectrum. He d. at Munich on the 7th of June, 1826.

FRAUNHOFER'S LINES. See SPECTRUM.

FRAU'STADT (Polish, Wszowa), a t. of Prussia, in the government of Posen, is situated in a sandy plain on the Silesian frontier, 55 m. n.w. of Breslau. It has linen, woolen, and other manufactures, and important grain markets. In the vicinity are about 100 wind-mills. Pop. '75, 6,435.

FRAXINELLA. See DITTANY.

FRAXINUS. See ASH.

FRAYSSINOUS, DENIS ANTOINE LUC, Compte de, 1765–1841; a French bishop and Bourbon minister, orator, and controversial writer, ordained a priest in 1789. In Nov., 1801, he began the catechetical lectures which finally developed into the "conferences" of St. Sulpice, where his oratory and lucid exposition attracted great crowds. After Napoleon's arrest of the pope in 1809, his lectures were prohibited; but he returned with the Bourbons in 1814. The events of the hundred days compelled another retirement, from which he emerged in 1816, to be court-preacher and almoner to Louis XVIII. He became bishop of Hermopolis, grand master of the university, member of the academy, peer of France, and minister of ecclesiastical affairs, and public instructor. One of the most important of his administrations was the recall and restoration of the Jesuits in the schools and churches. His most important work is *Defense of Christianity*, issued in 1825, and published in several languages. The revolution of 1830 compelled his resignation, and he retired to Rome, passing his closing years in privacy.

FRAZEE, JOHN, architect; 1790–1852; b. N. J. He began business as a stone-cutter in New Brunswick in 1814, and afterwards had a marble-yard in New York, where his works on mantel-pieces and monuments attracted attention. He made busts of several notable men, including chief-justice Marshall, gen. Jackson, Daniel Webster, John Jay, judge Story, and William H. Prescott. He was a partner of Launitz, and the two were tutors of Crawford.

FRAZIER'S FARM, BATTLE OF, June 30, 1862, an attempt on the part of the confederates to prevent the unionists from re-establishing their communication with James river. The effort was unsuccessful, and the union troops reached Malvern hill on the morning of Aug. 1, and communication with their base of supplies was insured. The conflict is sometimes called the battle of Market cross-roads, or battle of Glendale. The losses were about 1800 on the union, and 2,000 on the confederate side.

FREDEGONDA, 545–597; a queen of the Franks, of low origin, the mistress of Hilperic or Chilperic I., king of Neustria. She induced him to repudiate his true queen, but was disappointed when he married Galsuinda, the sister of the famous Brunhilde (not the mythical Brunhilde of the Volsunga saga), wife of Siegbert, king of Austrasia. Fredegonda caused Galsuinda to be assassinated, and became her successor. She induced a war in which Siegbert was the victor, but he soon afterwards fell by Fredegonda's assassins. Brunhilde was taken captive, but escaping, fled to her own country. Fredegonda's next victim was Meroveus, son of Chilperic, who had been secretly married to Brunhilde. Clovis, his brother, was also killed on a false accusation, and her career of crime continued. Finally, she caused the assassination of her husband, and, seizing the reins of government on behalf of her son Clothaire, retained possession of them until her death.

FREDERI'CIA, a seaport and fortress of Denmark, is situated on the e. coast of the province of Jutland, on a projecting tongue of land, at the northern entrance to the Little Belt. It is fortified with nine bastions and three ravelins on the land side, and with two bastions towards the sea. It has several ecclesiastical edifices, a hospital, and a custom-house, at which toll used to be paid by ships passing through the Little Belt. Tobacco is grown and manufactured here. Pop. '70, 7,186.

FREDERICK, a co. in n. Maryland on the Pennsylvania border, n.e. of the Potomac, and intersected by the Monocacy river; also intersected by the Baltimore and Ohio, and a branch of the Pennsylvania railroads, and the Chesapeake and Ohio canal; 770 sq.m.; pop. '70, 47,572—7,572 colored. South mountain, a portion of the Blue Ridge range, runs along the w. border. The surface is hilly or undulating, and the soil fertile, producing wheat, corn, oats, hay, butter, etc. Co. seat, Frederick.

FREDERICK, a co. in n. Virginia on the West Virginia border, drained by Opequan, Back, and Cedar creeks, and intersected by the Harper's Ferry branch of the Baltimore and Ohio railroad; 378 sq.m.; pop. '70, 16,596—2,733 colored. The surface is diversified, and is remarkable for beauty of scenery. The soil is fertile; principal products, wheat, corn, and oats. Co. seat, Winchester.

FREDERICK III., ELECTOR OF BRANDENBURG, son and successor of FREDERICK WILLIAM, and the first king of Prussia, was b. in 1657, and succeeded to the electorate of Brandenburg in 1688. He exhibited the same zeal as his father for the aggrandizement and amelioration of his dominions; but he was distinguished from him by his admiration of Louis XIV., whose pomp and luxurious display he imitated at his own court. He supported William of Orange in his attempt on England, and gave him a subsidy of 6,000 men, which, under the command of marshal Schomberg, contributed to gain the victory at the Boyne which decided the fate of James II. F. was always

ready to lend troops and money to his allies; he sent 6,000 of his best men to aid the imperialists against the Turks; and although he met with the same ingratitude as his father, he succeeded, by treaties, exchanges, and purchases, in very considerably extending his territories; and after many years' negotiations, he induced the emperor to agree to the "crown treaty," by which, in return for permission to assume the title of king of Prussia, he bound himself to furnish certain contingents of men and money to the imperial government. As soon as this treaty had been signed, F. hastened in midwinter with all his family and court to Königsberg, where, on the 18th Jan., 1701, he placed the crown on his own head. He died Feb. 25, 1713. F. did much to embellish Berlin, where he founded the royal academy of sciences, and the academy of painting and sculpture, erected several churches, and laid out numerous streets. He established a court of appeal at Berlin, built the palace of Charlottenburg, and founded the university at Halle; but his actions were generally influenced by a love of display; and his vanity, together with his neglect of those who had served him, made him personally unpopular, although his patriotic love of Germany redeemed, in the eyes of his countrymen, many of his bad points.

FREDERICK I., OF DENMARK, was b. in 1473, and died in 1533. During the disturbed reign of his nephew, Christian II., he behaved with so much circumspection, that the choice of the nation fell upon him when the king was deposed, and he was raised to the throne in 1523. He showed great cruelty to his unfortunate relative, whom he detained in close captivity; but he was a politic ruler. In 1527, he embraced the Lutheran faith, which he established in his dominions by the most arbitrary measures.

FREDERICK III., OF DENMARK, the son of Christian IV., was b. in 1609, succeeded to the throne in 1648, and died in 1670. The wars of his father's reign had brought the country to a state of great embarrassment; and notwithstanding all his efforts to maintain peace, F. was continually embroiled in the quarrels of other nations, and during his reign Copenhagen was twice besieged by the Swedes under their warlike king, Charles Gustavus; nor was peace re-established till after the death of Charles. The reign of F. III. was rendered memorable by the change effected in the constitution, which, after having been in some degree elective, was at once changed into a hereditary and absolute monarchy by the voluntary act of the commons and clergy, who, from abhorrence of the nobility, surrendered to the crown the liberties and prerogative which they had hitherto enjoyed, and made the sovereign absolute and irresponsible.

FREDERICK V., OF DENMARK, the son and successor of Christian VI., was b. in 1723, ascended the throne in 1746, and died in 1766, leaving the reputation of having been one of the best and wisest monarchs of his time. Denmark owed to him the increase of her national wealth, and the establishment of various branches of commerce and manufacture. F. established a Greenland company, opened the American colonial trade to all his subjects, founded the military academy of Soroe, in Denmark, and caused schools to be opened at Bergen and Trondhjem, in Norway, for the instruction of the Laplanders. He established academies of painting and sculpture at Copenhagen, and sent a number of learned men—among whom was Niebuhr, the father of the historian—to travel and make explorations in the east.

FREDERICK VI., OF DENMARK, the son of Christian VII. and Caroline Matilda of England, was b. in 1768, and assumed the regency of the kingdom in 1784, on account of the insanity of his father, on whose death, in 1808, he ascended the throne. In this reign, feudal serfdom was abolished, monopolies abrogated, the criminal code amended, and the slave-trade prohibited earlier than in any other country. In 1800, Denmark joined the maritime confederation formed between Russia, Sweden, and Prussia, which led to retaliation on the part of England, to the seizure by that power of all Danish vessels in British ports, and to the despatch of a powerful fleet, under sir Hyde Parker and Nelson, to give efficacy to the peremptory demand that the regent should withdraw from the convention. His refusal to accede to this demand was followed by a fierce naval engagement, in which the Danish fleet was almost wholly destroyed. A peace was concluded on the regent's withdrawal from the confederation; but in consequence of his persisting to maintain an attitude of neutrality, instead of combining with Great Britain against Napoleon, the war was renewed in 1807 by the appearance, before Copenhagen, of a British fleet, bearing envoys, who summoned F. to enter into an alliance with England, and to surrender his fleet and arsenals, and the castle of Cronborg, commanding the sound. On his refusal, Copenhagen was bombarded for three days, the arsenals and docks destroyed, and all the shipping disabled, sunk, or carried to England. This blow paralyzed the national resources, and it required the exercise of much discretion on the part of the government, and great endurance on that of the people, to prevent the irremediable ruin of the country. Smarting under the treatment which he had experienced from the English, the Danish monarch became the ally of Napoleon, and suffered proportionally after the overthrow of his empire. In 1814, Norway was taken by the allies from Denmark, and given to Sweden. The state became bankrupt, and many years passed before order could be restored to the finances. Notwithstanding his autocratic tendencies, F. so far yielded to the movements of the times as to give his subjects, in 1831, a representative council and a liberal constitution. He died Dec. 3. 1839.

FREDERICK VII., OF DENMARK, the late king of Denmark, was b. in 1808, and succeeded his father, Christian VIII., in 1848. The principal events of his reign were the wars and diplomatic negotiations arising out of the revolt of the duchies of Holstein and Slesvig (q.v.), and the vexed question of the succession to Denmark proper and the duchies on the death of the king and of his uncle, the heir-presumptive, both of whom were childless. Notwithstanding the heavy expenses of the war, the material prosperity of the country increased during F.'s reign. He died 15th Nov., 1863.

FREDERICK (Ger. FRIEDRICH) I., OF GERMANY.—Frederick I., emperor of Germany, surnamed BARBAROSSA (Redbeard), was b. in 1121, succeeded his father, Frederick Hohenstaufen, as duke of Swabia in 1147, and his uncle, Conrad III., as emperor in 1152. He was one of the most enlightened and powerful rulers who ever swayed the imperial scepter. In his desire to emulate Charlemagne, and to raise the secular power of the empire in opposition to the arrogated supremacy of the papal chair, he was brought into constant collision with his Italian subjects. Six times he was compelled to cross the Alps at the head of great armies, in order to chastise the refractory cities of Lombardy, which were ever ready, on the slightest provocation, to throw off their allegiance. In the early periods of his reign, he visited their defection with undue severity; but in his latter days his conduct towards them was characterized by a generous leniency and a politic liberality in advance of his age; and in 1183, he convoked a council at Constance, in which he finally agreed to leave the Lombard cities the right to choose their own municipal rulers, and to conclude treaties and leagues among themselves, although he retained his supremacy over them, together with the power of imposing certain fixed taxes. The difficulty of settling the Italian differences was as usual aggravated in F.'s time by the attitude assumed by the occupants of the papal chair, and at one time Italy was distracted by the pretensions of two rival popes, Alexander III. and Victor IV., who each excommunicated the other, and hurled the anathemas of the church against their several opponents; and it was not till 1176 that F., after his defeat at Lignano, by consenting to acknowledge Urban II., the successor of Alexander III., as the rightful pope, was enabled to turn his attention to Germany. By his energetic measures, he succeeded in thoroughly humbling his troublesome vassal, Henry the Lion, duke of Brunswick, and thus crushing the Guelfic power in Germany. F. made Poland tributary to the empire, raised Bohemia to the rank of a kingdom, and the markgrafdom of Austria into an independent hereditary duchy. In 1189, F., having settled the affairs of the empire, and proclaimed universal peace in his dominions, resigned the government to his eldest son, Henry, and, at the head of 100,000 men, set forth for the Holy Land, accompanied by his second son, Frederick of Swabia, the founder of the order of Teutonic knights. After gaining two great victories over the Saracens at Philomelium and Iconium, he was drowned (1190) in a river of Syria, while trying to urge his horse across the stream. His remains were rescued by his son, and buried at Tyre. The death of F., which led to the dispersion of the crusaders before any material advantage had been obtained over the infidels, excited the deepest grief in Germany, where his memory has always been cherished as that of the best and wisest of his race. F. was a patron of learning, and enacted many admirable laws, some of which are still in force.

FREDERICK II., OF GERMANY, grandson of the former, and son of the emperor Henry VI., and of Constance, heiress of Sicily, was b. in 1194. His mother secured the favor of pope Innocent III. for her infant son, by conceding many important privileges to the papal chair: and after the civil war which had raged in Germany for eight years between the rival claimants of the throne, Philip of Swabia and Otho IV., was brought to an end by the agency of Innocent, F. succeeded (1812) in obtaining the support of the German electors. On his promising to undertake a crusade, the pope sanctioned his coronation at Aix-la-Chapelle in 1215. Like his grandfather, F. was actuated by an ardent desire for the consolidation of the imperial power in Italy at the expense of the pontificate, which he wished to reduce to the rank of a mere archiepiscopal dignity. Having secured the nomination of his son Henry to the rank of king of the Romans, and appointed archbishop Engelbert of Cologne as his vicegerent, he left Germany; and after having been crowned emperor at Rome, in 1220, devoted himself to the task of organizing his Italian territories. He founded the university of Naples, gave encouragement to the medical school of Salerno, invited to his court and patronized men of learning, poets, and artists, and commissioned his chancellor, Petrus de Vineis, to draw up a code of laws, to suit all classes of his German and Italian subjects. F.'s schemes for the union of his vast and widely scattered dominions were, however, frustrated by the refractory conduct of the Lombard cities, and still more by the arrogance of the popes Honorious III. and Gregory IX., who threatened him with excommunication unless he fulfilled his pledge of leading a crusade. Being compelled to depart on this expedition, he made the necessary preparations for its prosecution; but a pestilence having broken out among his troops in the Morea, he returned in haste to Italy, only to be again forced away by papal threats. This second attempted crusade proved more successful; and in 1228, notwithstanding the machinations of the pope, and the treachery of the Knights Templars, F. extorted a ten years' truce from the Moslem ruler, and forced him to give up Jerusalem and the territory around Joppa and Naza-

reth. The rest of his life was spent in bringing his rebellious Lombard subjects to subjection, and in counteracting the intrigues of the pope, the rebellion of his eldest son, and the treachery of his friend and minister, the chancellor Petrus de Vineis, who was suspected of attempting to poison him. F., who died suddenly in 1251, the possessor of seven crowns, was the most accomplished sovereign of the middle ages, for he not only spoke and wrote the six languages common to his subjects but he was famed for his talents as a minnesinger, and for his skill in all knightly exercises, while he wrote elaborate treatises on natural history and philosophy. His strong sympathies with his Italian mother-land, and his unremitting endeavors to establish a compact and all-supreme empire in Italy, were the causes, not only of his own misfortunes, but of the miseries which he brought upon the German empire, by embroiling him in costly wars abroad and leading him to neglect the welfare and sacrifice the interests of his German subjects. See for Frederick I. and Frederick II., Raumer, *Geschichte der Hohenstauffen ;* Sismondi, *Italian Republics*, and *Europe in the Middle Ages;* Voigt's *Lombardenbund;* Funk, *Geschichte Kaiser Friedrich II.*

FREDERICK III., OF GERMANY.—Frederick, who was F. III. as emperor of Germany, F. IV. as king of Germany, and F. V. as duke of Austria, was b. in 1415, being the son of duke Ernst, of the Styrian branch of the house of Hapsburg. At the age of 20, he undertook an expedition to the Holy Land; and on his return, in conjunction with his factious brother, Albert the prodigal, he assumed the government of his hereditary dominions of the duchy of Austria, the revenues of which scarcely exceeded 16,000 marks. On the death of the emperor Albert II., he was unanimously elected as his successor; and two years afterwards, in 1442, he was solemnly crowned at Aix-la-Chapelle; ten years later, he received the imperial crown at the hands of the pope of Rome, and in 1453, secured the archducal title to his family. His reign was a prolonged struggle against domestic intrigues and foreign aggressions. One of his most troublesome opponents was his brother Albert, who refused to give up the provinces which he held until he had received a large sum of money; but notwithstanding these causes of annoyance, and while John Hunyades Corvinus, at the head of a Hungarian army, overran Austria, and laid siege to Vienna, and the usurper Sforza possessed himself of the imperial fief of Milan, on the extinction of the male line of the visconti, F. remained absorbed in his own private studies, or roused himself only to attempt, by the aid of foreign mercenaries, to recover the crown-lands of which the house of Austria had been deprived. His pusillanimous subserviency to the papal chair, and his wavering policy, irritated the electors, who at one time cherished the design of deposing him and nominating George Podiebrand, king of Bohemia, to the imperial throne; while it entangled him in quarrels on account of the succession to the palatinate, and other questions of German policy, and deprived the church in Germany of that independence from the thraldom of the papal chair which it had been the object of the council of Basel to secure to it. The contempt in which F. was held was made apparent on the death of his ward, Ladislaus, king of Hungary and Bohemia, without children, when, notwithstanding his just pretensions to this inheritance, he was passed over, the people of the former having chosen George Podiebrand as their king, and those of the latter Matthias Corvinus. His brother Albert's death in 1463, secured him a short reprieve from internal disturbances, and gave him possession of upper Austria; but he was repeatedly embroiled in quarrels with Podiebrand and Matthias; the latter of whom several times besieged Vienna, and finally dispossessed him of every town of importance in his hereditary domains. In the meanwhile, the Turks were suffered to push their conquests in Europe until they had advanced in 1456 to Hungary, in 1469 to Carniola, and in 1475 to Salzburg, although a vigorous opposition at the outset would easily have put a definite stop to their encroachments. On the death of Matthias, in 1490, F. recovered Austria, but he was obliged to acknowledge prince Ladislaus of Bohemia as king of Hungary. This mortification was soon followed by his death, in 1493, after an inglorious reign of 53 years, which did nothing to advance the prosperity or progress of the empire, although the times were propitious to both. But although F. neglected the interests and duties of the imperial crown to indulge in the pursuit of his favorite studies in alchemy, astronomy, and botany, he never lost an opportunity of promoting the aggrandizement of his own family, which he very materially secured by marrying his son and successor, Maximilian, to Mary, the rich heiress of Charles the bold of Burgundy. F. was temperate, devout, parsimonious, scrupulous about trifles, simple in his habits, pacific in his disposition, and naturally averse to exertion or excitement. From his time, the imperial dignity continued almost hereditary in the house of Austria, which has perpetuated the use of his favorite device, A. E. I. O. U., *Austriæ Est Imperare Orbi Universo.* See Æneas Sylvius, *Historia;* Coxe, *House of Austria.*

FREDERICK I., 1425–76; Elector Palatine, called the "victorious." At the death of his father, in 1439, a portion of the palatinate devolved upon him, which he later ceded to his brother Louis IV. In 1449, upon the death of Louis, he assumed the guardianship of his infant nephew Philip, and administered the government. The threatening attitudes assumed towards him by the neighboring princes in 1452 determined him to assume the office of elector for life, with the understanding that his children should not rank as princes, and that the succession should devolve upon his

nephew. A coalition was at once formed against him, headed by the emperor Frederick III., but he defended himself ably, and in 1462 defeated at Seckenheim a combined army led against him by the elector Albert Achilles of Brandenburg. His success secured him undisturbed possession of his kingdom till his death. More than 60 fortresses and towns were added to the palatinate during his reign. He left two sons, the elder of whom, Frederick, adopted the ecclesiastical profession; while the younger, Louis, was the founder of the family of the princes and counts of Löwenstein.

FREDERICK II., 1482–1556; Elector Palatine, surnamed the "wise," was the fourth son of Philip the nobleminded, and assumed the electoral crown in 1544, succeeding his brother Louis. When, in 1529, the sultan Soliman besieged Vienna, he assumed command of the imperial army. In 1535, he espoused Dorothea, daughter of Christian II., ex-king of Denmark. Becoming familiar through the teaching of Melanchthon with the principles of the reformation, he joined the Smalkald league, and in later life signed the Augsburg interim and became reconciled to Charles V.

FREDERICK III., 1515–76; Elector Palatine, surnamed the "pious," was the eldest son of John II., palatine of Simmern. In 1556, he succeeded his father, and, on the death of Otto Henry, in 1559, became elector palatine. In 1537, he married the Lutheran princess, Maria of Brandenburg-Baireuth, and declared himself Protestant. In 1560, he established the reformed or Calvinistic worship, which induced an unsuccessful attempt by several of the Lutheran princes in 1566 to obtain an imperial edict against him.

FREDERICK IV., 1574–1610; Elector Palatine, surnamed the "upright," son of elector Louis VI. and Elizabeth of Hesse. His father dying during his infancy, he succeeded, under the guardianship of his uncle, John Casimir, in 1583, but only assumed the reins of government in 1592 upon his uncle's death. The steadfast and firm support he accorded to the Protestant cause renders his reign of importance, as by the protection he afforded it, the Protestant union of Germany was formed in 1601. He raised Manheim, where many Protestants had taken refuge, to the dignity of a town.

FREDERICK V., Prince Palatine.—Frederick V., electoral prince Palatine, was b. in 1596, succeeded to the Palatinate in 1610, was king of Bohemia from 1619 to 1620, and died in 1632. He married, in 1613, Elizabeth, the daughter of James VI. of Scotland and I. of England, through whose ambitious counsels he was induced to take a prominent part in the proceedings of the union of the Protestant princes of Germany, and finally, although against his own inclinations, to accept the title of king of Bohemia. His complete defeat at the battle of Prague terminated his short-lived enjoyment of the regal crown, of which he retained no other memorial but the mocking title of "the winter king." Ridicule and contumely followed him wherever he went, and the rest of his life was spent in exile under the ban of the empire, and with no resources beyond those which he could obtain from the generosity of his friends. In 1623, he was declared to have forfeited his electoral title and his dominions in the Palatinate, which were conferred upon his cousin, Maximilian of Bavaria, the Head of the Catholic league.

FREDERICK II., of Prussia, surnamed "the Great," was the son of Frederick-William I. and the princess Sophia-Dorothea, daughter of George I. of Great Britain, and was b. in 1712. His early years were spent under the restraints of an irksome military training, and a rigid system of education. His impatience under this discipline, his taste for music and French literature, and his devotion to his mother, gave rise to dissensions between father and son, and resulted in an attempt on the part of F. to escape to the court of his uncle, George II. of England. Being seized in the act, his conduct was visited with still greater severity, and he himself was kept in close confinement, while his friend and confidant, lieut. Katt, was executed in his sight, after having been barbarously ill-treated by the king. According to some reports, the prince's life would have been sacrificed to the fury of his father, had not the kings of Sweden and Poland interceded in his favor. Having humbly sued for pardon, he was liberated, and allowed to retire to Ruppin, which, with the town of Rheinsberg, was bestowed upon him in 1734. Here he contined to reside till the king's death, surrounded by men of learning, and in correspondence with Voltaire, whom he especially admired, and other philosophers; but on his accession to the throne in 1740, he laid aside these peaceful pursuits, and at once gave evidence of his talents as a legislator, and his determination to take an active share in the political and warlike movements of the age. His first military exploit was to gain a victory at Mollwitz over the Austrians, in 1741, which nearly decided the fate of Silesia, and secured to Prussia the alliance of France and Bohemia. Another victory over the empress Maria Theresa's troops made him master of upper and lower Silesia, and closed the first Silesian war. The second Silesian war, which ended in 1745, from which F. retired with augmented territories and the reputation of being one of the first commanders of the age, was followed by a peace of 11 years, which he devoted to the improvement of the various departments of government, and of the nation generally, to the organization of his army, and the indulgence of his literary tastes. The third Silesian war, or "the seven years' war," was begun in 1756 by the invasion of Saxony—a step to which F. was driven by the fear that he was to be deprived of Silesia by the allied confederation of France, Austria, Saxony, and Russia.

This contest, which was one of the most remarkable of modern times, secured to F. a decided influence in the affairs of Europe generally, as the natural result of the pre-eminent genius which he had shown both under defeat and victory; but although this war crippled the powers of all engaged in it, it left the balance of European politics unchanged. It required all the skill and inventive genius of F. to repair the evils which his country had suffered by the war. In 1772, he shared in the partition of Poland, and obtained as his portion all Polish Prussia and a part of great Poland; and by the treaty of Teschen, in 1779, Austria was obliged to consent to the union of the Franconian provinces with Prussia, and he was thus enabled to leave to his nephew and successor a powerful and well-organized kingdom, one half larger in area than it had been at his own accession, with a full treasury, and an army of 200,000 men. He died at the château of Sans Souci, Aug. 17, 1786. Frederick the great is said to have "inherited all his father's excellences and none of his defects." His courage, fertility of resource, and indomitable resolution, cannot be too highly praised. Not the least wonderful of his achievements was his contriving to carry on his bloody campaigns without incurring a penny of debt. A true spirit of self-sacrifice—though not, perhaps, for the highest ends—was in him. Never was king more liberal towards his subjects. In Silesia, where war had nearly ruined the inhabitants, he once remitted the taxes for six months, and in Pomerania and New Brandenburg for two years, while his government was carried on with rigid economy, such as Europe had never before witnessed. But not only was his government economical, it was essentially just. Religious persecution was unknown, civil order everywhere prevailed; property was secure, and the press was free. On the other hand, F.'s faults were far from being few. Education had made him French in all his ideas and prejudices; and in those days, to be French was to be sceptical. He was utterly unconscious of the grand intellectual and spiritual life that was about to spring up in Germany, and to make it again the guiding-star of Europe, as it had been in the days of Luther. He was, in fact, almost ignorant of his native language, which, moreover, he despised as semi-barbaric; though before his death Goethe had published his *Götz von Berlichingen; Sorrows of Werther; Iphigenia in Tauris*, and many of his finest lyrics; while Kant, besides a variety of lesser works, had also given to the world his masterpiece, the *Critique of Pure Reason*. The new literature was essentially one of belief and aspiration, and therefore alien to the tendencies of the royal disciple of Voltaire, who had learned from his master to cherish at once contempt and suspicion of his fellow-creatures. This disagreeable feature of his character increased with years. He declared the citizen class to be destitute alike of ability and honor, and relied not on the love of the nation, but on his army and purse. F. was a very voluminous writer. Of his numerous works, all of which are written in French, his *Mémoires pour servir à l'Histoire de Brandenbourg*, and *Histoire de la Guerre de Sept Ans*, exhibit perhaps the greatest powers of description, but all evince talent of no common order. The academy of Berlin, by the direction of Frederick-William IV., brought out a fine edition of his collected works in octavo and quarto, 1846–51. Frederick left no children, and was succeeded by his nephew, Frederick-William II. See Carlyle, *History of Frederick II.;* Macaulay's *Essay;* and the lives by Dohm, Preuss, Förster, Kugler, Droysen, Klopp, Pelletan (1878).

FREDERICK I., 1369–1428; Elector and Duke of Saxony, called the "pugnacious." With his two brothers he succeeded, on the death of the father in 1381, to the inheritance, but they were compelled to divide with their two uncles. Frederick had previously distinguished himself as a soldier, and in 1423, in recognition of his success against the Hussites, the emperor Sigismund made him elector and duke of Saxony. He was defeated by the Hussites at Aussig in 1426, and died within two years. He founded the university of Leipsic in 1409.

FREDERICK II., 1411–64; Elector and Duke of Saxony, called the "meek;" son of Frederick I. and Catherine of Brunswick. His reign is remarkable only for the long quarrel with his uncles about the division of territory. The emperor interposed in 1451, and settled the question in his favor.

FREDERICK III., 1463–1525; Elector and Duke of Saxony, called the "wise;" grandson of Frederick II.; succeeded his father, duke Ernest, in the government. He founded the university of Wittenberg in 1502, and gave Luther and Melanchthon two of the chairs. He never adopted the creed of the reformers, but he accorded them toleration, protected Luther at the diet of Worms, and sheltered him in the castle of Wartburg. In 1493, he visited the Holy Land, and in Jerusalem was made a knight of the Sepulcher. On the death of Maximilian I. he was offered the imperial throne, but declined it, and it was given to Charles V.

FREDERICK AUGUSTUS I., 1750–1827; King of Saxony, son of the elector Frederick Christian; b. Dresden; succeeded his father under the guardianship of prince Xavier, in 1763. In 1769, he married princess Maria Amelia, of Deux Ponts. Family interests, his mother being the sister of the elector of Bavaria, induced him to side with Frederick the great in the Bavarian war of succession against Austria in 1778, and he afterwards joined the league of German princes formed by that monarch. In 1791, he was offered the crown of Poland, but declined it. For some time he would not join the league against France in 1792, but war being declared, his duty as a member of the German empire obliged him to take part in it.

During the war between France and Austria in 1805, he maintained a strict neutrality, but in the succeeding years he joined Prussia against France. The disastrous battle of Jena forced him to conclude a treaty of peace with Napoleon at Posen, Nov. 11, 1806, and after assuming the title of king he joined the Rhenish confederation. During the subsequent wars with Napoleon he was taken prisoner by the allies after the entry into Leipsic, Oct. 19, 1813, and although his liberation followed the congress of Vienna, he was compelled to cede the province of Wittenberg to Prussia. He devoted the remainder of his life to the development of the agricultural, commercial, and industrial resources of his kingdom, and directed his attention especially to the administration of justice. He established hospitals and other charitable institutions, and did much for the encouragement of art and science and the promotion of education. He was especially interested in botany, and the beautiful botanical gardens at Pillnitz originated with him. His reign was marked throughout by justice, probity, moderation, and prudence.

FREDERICK AUGUSTUS II., 1797–1854, King of Saxony, was the eldest son of prince Maximilian and of Caroline Maria Theresa of Parma. His youth was passed in such troubled times that he had frequently to change his residence, but his education was not allowed to suffer and his journeys in foreign states and his intercourse with men of eminence, assisted in his acquirement of a special taste for art and for natural science. He married twice—in 1819, the duchess Caroline, eldest daughter of Maximilian I., of Bavaria. In 1830, after an insurrection in Dresden, he was named joint regent of the kingdom with king Anthony—and his wise and liberal reforms, rendered him popular, and speedily quelled all discontent. In spite of the enlightened liberality of his administration, Saxony was not to escape the political troubles which assailed Germany in 1848. An insurrection in Dresden in May, 1849, obliged him to avail himself of the help of Prussian troops. But the rising once quelled, his reign continued tranquil and prosperous. His death was accidental, and was caused by the overthrow of his carriage between Imst and Wenns, in the Tyrol. Frederick devoted much of his leisure to the study of botany.

FREDERICK-CHARLES, a Prussian prince, son of prince Charles (brother of king William), was b. at Berlin, Mar. 20, 1828. In his early youth, he manifested a great liking for war-like occupations; and the first Slesvig-Holstein war (1849) saw him in the field as capt., and not without honor to himself; in the campaign in Baden also he gathered laurels and honorable wounds; and in the second Slesvig-Holstein war his name became famous through the storm of the Düppel intrenchments. But his chief title to fame rests on the part he played in the campaign of 1866 against Austria, where he commanded one of the invading armies, and where his able generalship contributed not a little to the final success of the war. He has, indeed, been blamed for excess of caution in advancing through Bohemia to the rendezvous at Gitschin, where his more prompt appearance, it is said, would have saved the Silesian army from the danger of serious disaster which it encountered in passing the defiles; but it may, in fairness, be assumed that the caution was necessary until the contrary is proved. Besides his services in the reorganization of the cavalry, he has written several military works of great merit. He commanded the second German army in the Franco-German war, and the investing forces when Metz capitulated, Oct. 27, 1870; and next day was made field-marshal by king William, now emperor of Germany. He was married to Marie Anna, princess of Anhalt, in 1854. In Mar., 1879, his third daughter, Louise Margaret, was married to the duke of Connaught.

FREDERICK CITY, a city of Maryland, U. S., 2 m. w. of the Monocacy river, 44 m. n.w. of Washington, 65 by railroad w. of Baltimore, on a branch of the Baltimore and Ohio railroad; a handsome town with 12 churches, four banks, college, academy, seminaries, two newspapers, and manufactories of iron, wool, leather, flour, and tobacco. Pop. '70, 8,526.

FREDERICK CITY (*ante*), a city and seat of justice of Frederick co., Md., in a valley 40 m. n.n.w. of Washington, on the Frederick and Pennsylvania line railroad which connects with the Baltimore and Ohio; pop. '70, 8,526—1822 colored. The city is regularly laid out and well built: lighted with gas and furnished with water from mountain springs. It has extensive trade and important manufactures of iron, flour, wool, paper, etc. Frederick college was established by the state in 1797; a female seminary was started in 1842; there is an establishment of the Jesuits, and a nunnery; and also the state institution for the deaf and dumb.

FRED'ERICKSBURG, a city of Virginia, U. S., is built in a fertile valley on the right bank of the river Rappahannock, at the head of tide-water, 110 m. from Chesapeake bay, 65 m. n. of Richmond, and had in 1870, the county buildings, five churches, several public schools, orphan asylum, extensive manufactories of flour and tobacco, and a population of 4.046. Dec. 13, 1862, it was the scene of a battle between the federal army, commanded by gen. Burnside, and the confederate army under gen. Lee, in which the former was repulsed, and driven back across the river with a loss of 12.321, while the confederates, strongly posted on the hills s. of the city, suffered but trifling damage; but the city itself was nearly destroyed.

FREDERICKSBURG, BATTLE OF, Dec. 13-14, 1862. After the battle of Antietam, in the middle of Sept., the union commander (McClellan) remained inactive so long that the people demanded a movement from him or his deposition from command. Near the end of Oct., his forces began to cross the Potomac, while the confederates moved to the valley of the Rappahannock. Early in Nov., the union forces concentrated near Warrenton, and the confederates near Culpepper, 20 m. south. Before McClellan was ready to make an attack he was removed (Nov. 7) and Burnside took his place. The objects at the time were to cover Washington, to take Richmond, or to break up the confederate army. By the middle of Nov., Lee had concentrated the whole of the confederate forces. The union army was organized in three divisions, the right under Sumner, the left under Franklin, the center under Hooker. Burnside resolved to cross the Rappahannock at Fredericksburg, Dec. 11. Three bridges were to be made; Sumner to cross by the upper, Franklin with a part of Hooker's men at the lower; the remainder of Hooker's men to be held in reserve. On the 12th the crossing was effected. The next morning was foggy. The forces were rated at 100,000 unionists, and 80,000 confederates. The attack began early and continued all day. There was a great deal of severe fighting, but all efforts to carry the strong points of the confederates failed. The confederates lay under arms through the night, expecting another attack in the morning. Although Burnside had determined to renew the attack and gave his orders to that effect, he desisted at the earnest persuasion of Sumner, who, with every other corps commander, looked upon such an assault as hopeless. The armies remained in their respective positions up to the night of the 15th, when, taking advantage of a violent storm, Burnside led his forces to the n. bank of the river. The official report of the union loss at Fredericksburg was 1138 killed, 9,105 wounded, and 2,078 missing; total, 12,321; while on the confederate side the loss was 5,309—595 killed, 4,061 wounded, 563 missing.

FREDERICK-WILLIAM, ELECTOR OF BRANDENBURG, commonly called "the great elector," was b. in 1620, succeeded to the electorate in 1640, and d. in 1688. On his accession, he found an empty exchequer, the towns and cities depopulated, and the whole electorate devastated by the ravages of the Swedish and imperialist armies during the thirty years' war, which was not yet concluded; while a portion of his inheritance had even been confiscated by the Swedes. His first acts were to regulate the finances, and to conclude a treaty of neutrality with Sweden, which left him at leisure to devote himself to the organization of his army, and the repeopling of the deserted towns and villages by means of immigration. By the treaty of Westphalia, through which he lost several important places, he recovered the eastern portions of Pomerania, Hohenstein, the bishoprics of Halberstadt, Minden, and Kamin, as lay-principalities, and the reversion of the archbishopric of Magdeburg. In the course of ten years he had, by the help of his generals, Derfflinger, Schomberg, and Kannenberg, created an army of 25,000 men, organized on the Swedish model; and having been constrained to enter into an alliance with Charles X., he co-operated with him in the taking of Warsaw, which was effected at the cost of a most sanguinary engagement in 1656. In return for this co-operation, Frederick-William secured the emancipation of his Prussian duchy from its former dependence on Poland. The aggressions of Louis XIV. on the Rhenish frontier alarmed the elector, who induced the emperor, the king of Denmark, and the elector of Hesse-Cassel, to enter into a league against France. The result was unfavorable to the cause of the German princes, and Frederick-William was obliged to content himself with making highly disadvantageous terms. The war was soon renewed, and Brandenburg was again a prey to the incursions of the Swedes, who, at the instigation of Louis, advanced upon Berlin, laying waste everything on their march. The elector, who had taken up his winter-quarters in Franconia, hurried across the Elbe at the head of his cavalry, and having signally defeated the Swedes, drove them from his dominions. If the emperor had been true to his word, and supported him, Frederick-William might have made head against the French; but being forsaken by the other German princes, and his dominions overrun by the troops of Louis, he was obliged to agree to the treaty of St. Germain, by which he restored all his conquests to the Swedes, in return for the withdrawal of the French army, and the payment to him of an indemnity of 300,000 crowns. From this time forth, Frederick-William devoted himself to the task of consolidating the prosperity of his dominions. During his reign, he more than tripled the area of his territories, and by his generous reception of 20,000 French Protestants, after the revocation of the edict of Nantes, and the encouragement which he afforded to the immigration of Dutchmen and other foreigners, he augmented the population of his states, and introduced numerous industrial arts among his subjects. He founded the university at Duisburg, and the royal library at Berlin, and reorganized the universities of Frankfort-on-the-Oder, and Königsberg, opened canals, established a system of posts, and greatly enlarged and beautified Berlin. He left a well-filled exchequer and a highly organized army. See Orlich, *Gesch. des Preuss. Staats im 17 Jahrh.* Berl. 1839.

FREDERICK-WILLIAM, DUKE OF BRUNSWICK, b. in 1771, entered the Prussian service at an early age, and was actively engaged with the army during the war with France in 1792, and again in 1806, and was taken prisoner with Blücher at Leipsic. On the death of his father and eldest brother, he would have succeeded to the duke-

dom, as his other brothers were incapacitated by disease for reigning, had not Napoleon put a veto on his accession to power. Being resolved to take part in the war against the French, he raised a free corps in Bohemia, and threw himself into Saxony, which he was, however, speedily compelled to evacuate. After the total defeat of the Austrians in 1809, the duke determined to leave Germany; and with his corps of 700 "black hussars," and 800 infantry, he began his masterly retreat. After various skirmishes, in one of which he defeated the Westphalian commander Wellingerode and a picked detachment of troops, he reached Brunswick, in the neighborhood of which he gained a victory at Oelper over 4,000 Westphalians, commanded by gen. Reupel. He next crossed the Weser, and having reached Elsfleth, and taken possession of a sufficient number of vessels and seamen, he embarked his troops; and finally, after stopping at Heligoland, landed in England with his men in Aug., 1809. He was received with enthusiasm; and having entered the English service with his men, subsequently took part in the Peninsular war, where he served with distinction, receiving from the British government an allowance of £6,000 a year, which he retained till his return to his own dominions in 1813. Although no prince could be more earnestly bent on securing the welfare of his subjects, his efforts failed utterly from the untimely and injudicious nature of the reforms he endeavored to effect; while the magnitude of his military establishments, which were quite unsuited to the limited extent of his territories, excited the ill-will of his people. He joined the allied army with his hussars after the return of Napoleon from Elba, and fell gloriously while leading on his men at Quatre Bras, on the 16th of June, 1815.

FREDERICK-WILLIAM, Crown-prince of the German empire and of Prussia, only son of William I. (q.v.), king of Prussia and now German emperor, was b. Oct. 18, 1831. His earnest character and eminent talents were early developed under the care of excellent masters, among others of Ernest Curtius (q.v.), who also accompanied him to the university of Bonn, where the prince was matriculated in the law faculty. After the completion of his education, the prince visited several foreign countries, among others, England, where it seems he became attached to the princess-royal, eldest daughter of queen Victoria, and was married to her on the 25th Jan., 1858, with the highest approbation of both nations. Of the issue of this union, there are now living two sons (the eldest Frederick-William, born 27th Jan., 1859), and four daughters. Since his father ascended the throne, the crown-prince has taken part in the more important affairs of state. He served in the Danish campaign in a subordinate capacity; nevertheless, he gave sufficient proofs of his great ability, to cause the king to intrust to him an important (according to some, *the most important*) task in the war with Austria in 1866, namely, the command of the left Prussian wing operating in and from Silesia. How ably the prince played his part at Königgrätz is well known. In the Franco-German war, 1870–71, he acted a very conspicuous part as commander of the troops of Bavaria, Würtemberg, and Baden. He was present at Sedan, Aug., 1870; and was made a field-marshal two months after by his father. Frederick-William is heir-presumptive to the imperial crown of Germany, as well as the throne of Prussia. During the emperor's illness caused by an assassin's shot in 1878, his public functions were performed by the crown-prince.

FREDERICK-WILLIAM I., OF PRUSSIA, b. in 1688, was in almost every particular the opposite of his father Frederick I. He was simple, and almost penurious in his habits, attentive to business, passionately fond of military exercises, but averse to mental cultivation, and fond of the society of the low and illiterate, while he carried to the utmost his ideas of arbitrary power and the divine right of kings. The public events of his reign were of little importance, although he was continually implicated in foreign wars, and he supported the cause of Stanislaus of Poland, and assisted Austria in her contests with France. He died in 1740. By his economy and reforms in the finances, he was able to indulge his taste for the organization of military forces, while his childish love of tall soldiers induced him to connive at the most flagrant outrages both at home and abroad for kidnapping tall men and forcing them into his service: the result of this system was, that he left at his death a well-drilled army of 70,000 soldiers, of whom a large proportion were men of gigantic stature. What was of more consequence to his son and successor was, that his exchequer contained 9,000,000 thalers, and that his kingdom had attained an area of more than 45,000 sq.m., and a pop. of upwards of 2,240,000. See Morgenstern, *Ueber Friedrich Wilhelm I.* (Braunsch. 1793); F. Förster, *Gesch. Friedrich-Wilhelm's I.* (Pots. 1835); Carlyle, *Hist. of Friedrich II., called Frederick the Great.*

FREDERICK-WILLIAM II., OF PRUSSIA, was b. in 1744, and d. in 1797. After a prolonged estrangement between his uncle and himself, he regained the good-will of the king by his valor in the war of the Bavarian succession in 1778; but although he succeeded to a well-consolidated power and an overflowing treasury, he had not the capacity to maintain his favorable position. Futile or hastily undertaken wars wasted his resources; so that at his death, instead of the overplus of 70,000,000 thalers that had been bequeathed to him, the state was hampered with a debt of 22,000,000. His predilection for unworthy favorites, the establishment of a strict censorship of the press, and the introduction of stringent ecclesiastic enactments, alienated the affections of the

people from him, although his natural mildness of disposition had excited the sanguine hopes of the nation on his accession. Frederick-William shared in the second partition of Poland in 1793, and thus gained a considerable addition to his kingdom, which, by purchase, inheritance, and other means, was augmented during his reign by the acquisition of more than 46,000 sq.m. of territory, and 2¼ millions of inhabitants. The chief internal improvements in this reign were the introduction of a new code of laws, and a less onerous mode of raising the taxes.

FREDERICK-WILLIAM III., OF PRUSSIA, the son of Frederick-William II., was b. in 1770. He early took part in the administration, and, on his accession in 1797, he at once dismissed the unworthy favorites of the preceding reign, and accompanied by his beautiful young queen, Louisa of Mecklenburg-Strelitz, made a tour of inspection through the numerous provinces of his kingdom, with a view of investigating their condition, and contributing to their local and general improvement. But although Frederick-William was well intentioned, and in his moral and domestic relations his conduct was exemplary, he lacked the dignity and force of will to cope with the difficulties of his position. By his efforts to maintain an attitude of neutrality in the great European struggle that had been excited by the wars and victories of the French, he awakened the distrust of all the great anti-Gallican powers of Europe, and disappointed the petty German princes, who had looked upon Prussia as their protectress against foreign encroachments. Napoleon's promises of support and friendly intentions soon changed this neutrality to an alliance with France, and for some time Prussia persevered in her dishonorable and self-seeking policy, which was rewarded by the acquisition of Hildesheim, Paderborn, and Münster, which added nearly 4,000 sq.m. of territory, and half a million of inhabitants to the kingdom; but at length the repeated and systematic insults of Napoleon, who despised Frederick-William while he professed to treat him as a friend, roused the spirit of the nation, and the king saw himself obliged, in 1805, to agree to a convention with Russia, the real object of which was to drive Napoleon out of Germany. Again the treachery of Prussia led her to make a new treaty with France, by which she consented to receive the electorate of Hanover, and thus involved herself in a war with England. The insults of Napoleon were redoubled after this fresh proof of Frederick-William's indecision. The Prussian nation, headed by the queen, now called loudly for war, and at the close of 1806, the king yielded to these appeals. Hostilities began without further delay; but the defeat of the Prussians at Jena, Eylau, and Friedland, compelled their unfortunate monarch to sue for peace. The Prussian army was annihilated, and the whole of the kingdom, with the exception of a few fortified places, remained in the power of the French. By the intervention of the emperor Alexander of Russia, a peace was concluded, known as the treaty of Tilsit, by which Frederick-William lost the greater part of his realm, and was deprived of all but the semblance of royalty; but although for the next five years he was a mere tool in the hands of Napoleon, who seized every opportunity of humbling and irritating him, his spirit was not subdued, and his unremitting efforts at this period of his life to reorganize his enfeebled government by self-sacrifices of every kind, endeared him greatly to his people. The disastrous termination of Napoleon's Russian campaign was the turning-point in the fortunes of Prussia; for although the French emperor was victorious over the Prussians and Russians in the battles of Lützen and Bautzen, which were fought soon after the declaration of war which Frederick-William had made against France, to the great joy of his people, in 1813, the allies were soon able to renew hostilities, which were carried on with signal success, until they finally culminated in the great battle of Leipsic, in which the Prussians, under their gen., Blücher, earned the greatest share of glory. The peace of Vienna restored to Prussia, almost all her former possessions, while the part taken by the Prussian, army under Blücher in gaining the victory of Waterloo, by which Napoleon's power was finally broken, raised the kingdom from its abasement. From that time, Frederick-William devoted himself to the improvement of his exhausted states; but although before the French revolution of 1830 Prussia had recovered her old position in regard to material prosperity at home and political consideration abroad, the king adhered too strictly to the old German ideas of absolutism, to grant his people more than the smallest possible amount of political liberty. He had indeed promised to establish a representative constitution for the whole kingdom, but this promise he wholly repudiated when reminded of it, and merely established the *Landstände*, or provincial estates, a local institution, devoid of all effective power. His support of the Russian government in its sanguinary methods of crushing revolutionary tendencies in Poland, showed his absolute tendencies, and his dread of liberal principles. Frederick-William was more than once embroiled with the pope, on account of his violation of the concordat. He concluded the great German commercial league known as the *Zollverein* (see GERMANY), which organized the German customs and duties in accordance with one uniform system. He died in 1840.

FREDERICK-WILLIAM IV., OF PRUSSIA, son of the foregoing, was b. Oct. 15, 1795. He had been carefully educated, was fond of the society of learned men, and was a liberal patron of art and literature. He exhibited much of his father's vacillation and instability of purpose; and although he began his reign (June 7, 1840) by granting minor reforms, and promising radical changes of a liberal character, he always, on one plea or

other, evaded the fulfillment of these pledges. He was possessed by high but vague ideas of "the Christian state," and showed through life a strong tendency to mystic pietism. The one idea to which he adhered with constancy was that of a union of all Germany into one great body, of which he offered himself to be the guide and head. He encouraged the duchies of Holstein and Slesvig in their insurrectionary movement, and sent troops to assist them against Denmark; but he soon abandoned their cause, and being displeased with the revolutionary character of the Frankfort diet, refused to accept the imperial crown which it offered him. The conspiracies in Prussian Poland were suppressed with much rigor; and the popular movement which followed the French revolution of 1848, was at first met by the king with resolute opposition; but when the people persisted in demanding the removal of the troops from the capital, and enforced their demand by storming the arsenal and seizing on the palace of the prince of Prussia (the present king), who was at that time especially obnoxious to the liberals, he was obliged to comply with their wishes. Constituent assemblies were convoked, only to be dissolved when the king recovered his former security of power, and new constitutions were framed and sworn to, and finally modified or withdrawn. After the complete termination of the revolution in Germany, the revolutionary members of the assembly of 1848 were prosecuted and treated with severity, the obnoxious "pietistic" party and the nobility were reinstated in their former influence at court, and the freedom of the press and of religious and political opinion, was strictly circumscribed. The life of the king was twice attempted; first in 1847 by a dismissed burgomaster, named Tschech; and secondly, in 1850, by an insane discharged soldier of the name of Sefeloge. In 1857, Frederick-William was seized with remittent attacks of insanity; and in 1858 he resigned the management of public affairs to his brother and next heir, who acted as regent of the kingdom till his own accession, in 1860, as William I. Frederick-William died in 1861.

FRED'ERICTON, the capital of the province of New Brunswick, in the dominion of Canada, stands on the right bank of the St. John, the largest river in the province. It is 56 m. to the n.w. of the principal seaport, which bears the name of the stream above mentioned, and it is itself accessible to vessels of 50 tons. Pop. '71, 6,006. In addition to the public buildings, which F. possesses as the seat of government, it contains the university of New Brunswick, which is well endowed, and has a good staff of professors.

FREDERICTON (*ante*), a city and port of entry in the province of New Brunswick, Canada; in York co., on St. John river, 54 m. n.n.w. of St. John; pop. '71, 6,006. The city is on a low point of land and is nearly surrounded by hills. It is well laid out, and has elegant public buildings, comprising the residence of the lieutenant-governor, government house, court-house, city hall, exhibition building, rink, university, barracks, etc. It is the seat of a bishop of the church of England, and the cathedral is a handsome edifice. The St. John river is navigable to this point, 84 m. from its mouth in the bay of Fundy, for large vessels; small steamers go 60 or 70 m. further up. This city is the terminus of the Fredericton and New Brunswick railways. There are many manufactories of iron, leather, machinery, etc. The place was founded by sir Guy Carleton in 1786, and first called St. Ann's.

FREDERIKSBORG, built on the island of Seeland, 22 m. n.n.w. of Copenhagen, in 1606–20, by Christian IV. of Denmark for a royal palace, after plans drawn by Inigo Jones. It is a red-brick castle of Gothic style, standing on three small islands in a lake. The great hall is elaborately decorated in the ceiling with carving, gilding, and painting, which employed the artist for seven years. There is a beautiful chapel, in which kings of Denmark have been crowned. It has a rich collection of portraits of royal and noble personages.

FRED'ERIKSHALD, a fortified seaport of Norway, in the department (amt) of Smalenen, stands on an inlet called Swinesund, near the Swedish border, about 60 m. s.s.e. of Christiania. It is beautifully situated, and is a neat, well-built town, with several handsome edifices. Its harbor is excellent; in it the largest vessels may be safely moored. F. largely exports deals and lobsters. Pop. 9,956. To the s.e. of the town stands the fortress of Frederiksteen, on a perpendicular rock 400 ft. high. This fortress, though often assaulted, has never yet been taken. While laying siege to Frederiksteen, Charles XII. of Sweden was killed, 1718; in commemoration of which event an obelisk was raised, in 1814, upon the spot where he fell.

FREDERIKSTAD, a fortified t. of Norway, at the mouth of the Glommen, 48 m. s.e. of Christiania; pop. '75, 9,562. It was founded by Frederick the great in 1657, and was for a long time strongly fortified. In 1716, Charles XII. of Sweden made an unsuccessful attempt to capture it. The most prominent buildings are the arsenal and the church. It has manufactures of hardware, pottery, and brandy, and some shipping and general commerce.

FREDO'NIA, a village in Chautauqua co., N. Y., on the Dunkirk, Alleghany Valley, and Pittsburg railroad, 3 m. s. of lake Erie; pop. about 3,000. A great curiosity is the natural spring of inflammable gas by which the place has been lighted for many years.

It possesses a state normal school and a training school, and considerable manufacturing business is carried on.

FREE BENCH, *Francus bancus*. By custom of certain manors in England, a widow was entitled to dower out of the lands which were held by her husband in socage (q.v.). In some places, the widow had the whole, or the half, and the like *dum sola et casta vixerit* (Co. Litt. 110, b). This right is called *francus bancus*, to distinguish it from other dowers, for that it cometh freely, without any act of the husband's or assignment of the heir (Co. Litt. 94, b). See DOWER. A widow who has forfeited her F. B. is, by the custom of some manors, permitted to recover her right. At East and West Enborne, in the county of Berks, and also in the manor of Chadleworth, in the same county, and at Torr, in Devon, if the widow commit incontinency, she forfeits her estate; yet if she will come into the court of the manor riding backward on a black ram, with his tail in her hand, and will repeat certain verses (more remarkable for their plainness than their delicacy), the steward is bound by the custom to admit her to her F. B. (Cowel's *Interpreter*, ed. 1727, fol.).

FREEBORN, a co. in s. Minnesota, on the Iowa border, drained by Shell Rock river, and intersected by the Southern Minnesota railroad; 720 sq.m.; pop. '75, 18,189. The surface is dotted with forests, prairies, and small lakes. The soil is fertile, producing cereals, butter, etc. Co. seat, Albert Lea.

FREE CHURCH OF ENGLAND. See REFORMED EPISCOPAL CHURCH.

FREE CHURCH OF SCOTLAND, the name assumed by those who at the "disruption" of the Established church of Scotland, in 1843, withdrew from connection with the state, and formed themselves into a distinct religious community, at the same time claiming to represent the historic church of Scotland, as maintaining the principles for which it has contended since the reformation.

(It is proper to state that, in accordance with a method adopted in other cases also in this work, the present article is written by a member of the church to which it relates, and is an attempt to exhibit the view of its principles and position generally taken by those within its own pale.)

There is no difference between the Free church of Scotland and the Established church in the standards which they receive; and all the laws of the church existing and in force prior to the disruption, are acknowledged as still binding in the one as much as in the other, except in so far as they may since have been repealed. The same Presbyterian constitution subsists in both churches, with the same classes of office-bearers and gradations of church courts. The Free church, indeed, professes to maintain this constitution and church-government in a perfection impossible in the present circumstances of the Established church, because of acts of parliament by which the Established church is trammeled, and interventions of civil authority to which it is liable. And the whole difference between the Free church and the Established church relates to the consent and submission of the Established church to this control of the civil power in things which the Free church regards as belonging not to the province of civil government, but to the church of Christ and to its office-bearers and courts, as deriving authority from Him; so that the controversy is often described as respecting the *Headship of Christ* or the *Kingdom of Christ*. It is to be borne in mind, however, that the doctrine of the headship of Christ over his church, as set forth in the Westminster standards, is fully professed both by the Established church and by the Free church of Scotland; the only question between them is, whether or not the existing relations of the Established church of Scotland to the state are consistent with the due maintenance and practical exhibition of this doctrine. And the question does not directly relate to *voluntaryism* (q.v.) Those who constituted the Free church of Scotland, in 1843, firmly believed that the church might be connected with the state, and receive countenance and support from it, to the advantage of both; whilst they maintained that there must not, for the sake of any apparent benefits flowing from such connection, be any sacrifice of the independence or self-government of the church, as the kingdom of Christ, deriving its existence, organization, and laws from Him. Nor has any change of opinion on this subject been manifested.

The Westminster Confession of Faith asserts "that there is no other head of the church but the Lord Jesus Christ;" and that "the Lord Jesus, as king and head of his church, hath therein appointed a government in the hand of church-officers, distinct from the civil magistrate;" it ascribes to these church-officers the right of meeting in "synods or councils," which it affirms to be "an ordinance of God;" and represents the exercise of church discipline as intrusted to them as well as the ministry of the word and sacraments. It ascribes to the civil magistrate much power and many duties concerning things spiritual, but no power in or over these things themselves. And all this was equally the doctrine of the church of Scotland before the Westminster Confession was compiled. The support which, in many parts of Europe, princes gave to the cause of the reformation, and the circumstance that states as well as churches were shaking off the fetters of Rome, led in many cases to a confounding of the civil and the spiritual. The church of Scotland accomplished its emancipation from Rome, not with the co-operation off the civil power, but in spite of its resistance; and after the reformation, the Scottish reformers and their successors were compelled to a closer study of

their principles, by the continued attempts of the civil rulers to assume authority over all the internal affairs of the church. But amidst their struggles, the Presbyterians of Scotland so far prevailed as to obtain at different times important acts of parliament in recognition of their principles, and "ratification of the liberty of the true kirk;" and finally, after the revolution of 1688, an act ratifying the Westminster Confession of Faith itself, and incorporating with the statute law of the realm all its statements concerning the province of church-judicatories and that of the civil magistrate, and the bounds of their respective powers.

The rights and privileges of the Presbyterian church of Scotland, guaranteed by the revolution settlement, were expressly secured by the treaty of union, and jealously reserved from the power of the British parliament; yet within five years afterwards, when Jacobite counsels prevailed in the court of queen Anne, an act was passed for the restoration of patronage in Scotland, with the design of advancing the Jacobite interest by rendering ministers more dependent on the aristocracy, and less strenuous advocates of the most liberal principles then known. This act soon became the cause of strife within the church of Scotland, and of separation from it; effects which have continually increased to the present day. How the church at first earnestly protested against the act; how this protest gradually became formal, and was at last relinquished; how the church-courts themselves became most active in carrying out the settlement of presentees, notwithstanding all opposition of congregations, are points to which it is enough here to allude. It is important, however, to observe that in all the enforcement of the rights given to patrons by the act of 1712, during the 18th c., and considerable part of the 19th, no direct invasion of the ecclesiastical province took place on the part of civil courts or of the civil power; the presentation by the patron was regarded as conveying a civil right at most to the benefice or emoluments only, whilst the church-courts proceeded without restraint in the induction of ministers; and in a few instances it happened that the benefice and the pastoral office were disconnected by the opposite decisions of the civil and ecclesiastical courts. And even the "forced settlements," in which the fullest effect was given by the church-courts to the will of patrons, were accomplished according to the ancient form, upon the *call* of the parishioners, inviting the presentee to be their minister, although the *call* was a mere form—in the words of Dr. Chalmers, "the expressed consent of a few, and these often the mere driblet of a parish."

When the "moderate" party, long dominant in the general assembly of the church of Scotland, became again the minority in 1834, the accession of the "evangelical" party to power was at once signalized by an attempt to restore the *call* to efficacy. This was done by the famous *veto law*, by which it was declared "that it is a fundamental law of this church that no pastor shall be intruded on any congregation contrary to the will of the people," and enacted, in order to give effect to this principle, that a solemn dissent of a majority of male heads of families, members of the vacant congregation, and in full communion with the church, shall be deemed sufficient ground for the rejection of the presentee. The veto law thus determined rather how strong an expression of dissent by the parishioners should be requisite to invalidate a call, than how strong an expression of assent should be requisite to give it validity; a circumstance which was afterwards much turned to account in controversy; as if the *veto* were a new and unconstitutional principle introduced; although it was certainly adopted as the least extreme mode of giving effect to the old principle which the law declared.

The same general assembly by which the veto act was passed, is memorable for the assertion of the constitutional principles and inherent powers of the church in another important particular, the admission of the ministers of "chapels of ease" to the same ecclesiastical status with the ministers of endowed parishes, in consequence of which they became members of church-courts, and had districts assigned to them *quoad sacra*, with full parochial organization.

The veto act was soon the subject of litigation in the court of session. A conflict arose which in various forms agitated the whole of Scotland, and which, ere long, related as much to the status of chapel ministers as to the rights of presentees to parishes; and indeed involved the whole question of the relations of civil and ecclesiastical powers, at least as far as the Established church was concerned. The first case carried into the civil court was that of a presentation to Auchterarder, in which the call to the presentee was signed by only two parishioners, whilst almost all who were entitled to do so according to the veto act, came forward to declare their dissent. The decision of the court of session, which, upon an appeal, was affirmed by the house of lords, was to the effect, that the rejection of the presentee on the ground of this dissent was illegal; the opinions of the judges in the Scottish court were indeed divided; but those in accordance with which the judgment was pronounced, asserted the right of the civil courts to review and control all proceedings of church-courts, a power which it was speedily attempted to put forth in other cases, to the extent of requiring presbyteries to proceed to the settlement of qualified presentees without respect to the opposition of congregations; interdicting the admission of ministers to pastoral charges even when no question of emoluments was involved; interdicting the *quoad sacra* division of parishes or any innovation on the existing state of a parish as to pastoral superintendence and the jurisdiction and discipline of the kirk-session; interdicting church-courts from pronouncing

ecclesiastical censures, and suspending or revoking them when pronounced; interdicting ministers from preaching the gospel and from administering the sacraments within certain parishes; determining who should and who should not be deemed entitled to sit and vote in general assemblies and other courts of the church; and other such things, wholly subversive of the independence of the church, and reducing it, if acquiesced in, to the condition of "a creature of the state." They were not, however, acquiesced in, and although in one instance ministers were brought to the bar of the court of session, and reproved for disregarding its authority, their protest against its claim to authority was maintained even there; and in the far greater number of instances its interdicts were broken without any attempt being made to call those who did so to account. It is impossible here to enter into the details of this struggle, which was brought to a final issue by the judgment of the house of lords in Aug., 1842, affirming a decree of the court of session, which required the presbytery of Auchterarder to take the ordinary steps towards the settlement of the presentee to Auchterarder, without regard to the dissent of the parishioners. The law of the land being thus decided by the supreme court to be such as they could not with good conscience comply with, and parliament having rejected an application, in the form of a "claim of right," for an act such as would have reconciled the duties of their position according to the law of the land, in the church by law established, with what they believed to be their duty towards Christ and according to his law; it now seemed to the greater number of ministers and elders holding the principle of the independence of the church that the only course open to them was to retire from their position by the sacrifice of the emoluments and benefits of an establishment. And this they did at the meeting of the general assembly on 18th May, 1843. Headed by Dr. Chalmers, Dr. Welsh, and others of the most eminent in the church, they left the appointed place of meeting of the general assembly, St. Andrew's church, Edinburgh, and proceeded to another place, previously prepared, Tanfield hall, Canonmills, where, in the midst of a great concourse of people, the first general assembly of the Free church of Scotland was immediately constituted, and Dr. Chalmers was unanimously called to the chair as its moderator. Four hundred and seventy-four ministers renounced their connection with the establishment, and along with them a great body of its elders and members.

Immediate steps were taken for completing the organization of the Free church, and extending it as much as possible into every district of Scotland. The forethought of Dr. Chalmers had already devised the sustentation fund (q.v.). The Free church undertook from the first the continued support of all the missions previously carried on by the church of Scotland; and all the missionaries hastened to declare their adherence to the Free church. An "education scheme" was soon afterwards undertaken; and *colleges* for the training of ministers were founded in Edinburgh, Glasgow, and Aberdeen. Considerable opposition was at first experienced on the part of landowners, who refused to grant sites for churches and other buildings; but this gradually gave way. The bitterness of feeling which at first existed between the Established church of Scotland and the Free church has long since very much passed away.

In 1873, the number of ministerial charges in the Free church of Scotland was 905. There are also numerous "preaching stations," in which preaching is regularly maintained, and other ordinances are administered under the care of presbyteries. Some of these are continually being added to the list of ministerial charges. The whole sum raised for religious and educational purposes by the Free church of Scotland up to Mar., 1873, or in about thirty years, was about £10,299,306, or rather more than £342,-310 a year. In this are included the sums devoted to the erection of churches, manses, school-buildings, colleges, etc. The sustentation fund for the year ending 15th May, 1873, amounted to £136,779 19*s.* 8*d.*; the missionary and educational funds to £77,350; congregational funds to £147,715 6*s.* 1*d.*

Since 1843, the history of the Free church has been generally that of peaceful progress. It has been agitated by questions respecting the administration of the sustentation fund, colleges, etc., which are of little interest to those beyond its own pale. It was brought into a litigation in the court of session, seeming to affect its fundamental principles. The minister of the Free church at Cardross, in Dumbartonshire, having been suspended by the general assembly of 1858, had recourse to the court of session, on the alleged ground of irregularity in the proceedings of the ecclesiastical judicatories, demanding the suspension of the sentence; and being on this account summarily deposed by the general assembly, he raised an action in the court of session, not only claiming damages, but to have the sentence rescinded and found null and void. The case terminated in a recognition of the independence of the church in things purely spiritual, and a full admission of its subjection to the civil courts in all things temporal, including the right of these courts to demand full information as to all ecclesiastical proceedings, and production of minutes and other documents, when they should see cause. Negotiations towards union with the United Presbyterian church gave rise to great dissension in the Free church itself, from the unwillingness of many of its members to modify their profession of the doctrine of the lawfulness of the establishment of the church by the state; and it seemed as if a disruption of the Free church was impending; but in 1873 the proposal of immediate union was laid aside, and peace in

the Free church restored. A similar proposal with regard to the reformed Presbyterian church was more successful, and the union was consummated in 1876.

FREE CITIES, the name given to those German towns, Hamburg, Bremen, Lübeck, and Frankfurt-on-the-Main, which were of themselves sovereign states and members of the German confederation. They are remnants of the once numerous "imperial" cities, or cities not subject to any superior lord, but immediately under the empire. Of the four F. C., Hamburg, Lübeck, and Bremen still retain their privileges under the reconstituted German empire; but Frankfurt (q.v.) was annexed to Prussia in 1866.

FREE CONGREGATIONS, sometimes called "Protestant Friends," an association of German rationalists who at first professed to be Christians, but afterwards rejected the doctrine of miraculous revelation. Some of them boldly reject the idea of a personal Deity. There are five or six congregations in the United States.

FREEDMEN'S BUREAU, a branch of the war department of the United States, established in 1865, to which was committed the supervision and management of abandoned lands, and the control of all subjects relating to refugees and freedmen from any district embraced within the territory covered by the operations of the army. It was managed by a commissioner, with a number of assistants. It was created to meet a special exigency: much of the work was long ago accomplished, and the principal functions of the bureau ceased in 1870. During its existence the bureau exercised a general supervision over the freedmen and other loyal refugees, protecting their rights, finding work and providing education for them, and furnishing medical treatment. More than 2,100 day and night schools were in operation in 1869, with 2,455 teachers, and 114,552 pupils. The bureau was instrumental in establishing institutions for the higher education of freedmen, such as Howard university at Washington, Atlanta university, Claflin university in South Carolina, and others. The number of rations issued to freedmen was over 15,000,000, and nearly 600,000 sick persons were cared for.

FREEDOM OF THE PRESS. See PRESS.

FREEHOLD, ESTATE OF (*liberum tenementum*, frank tenement). Real estates in England in the present day are divided into freehold and copyhold. By freehold property is meant all estates which owe no duty or service to any lord but the king. What are now known as estates of freehold were, under the feudal system, denominated frank tenements. They were held by the honorable tenure of knight's service (q.v.) and free socage (q.v.), and might have been held either of the crown or of a subject. But the statute of *quia emptores* having abolished subinfeudation, all freehold estates, except those which have been held of subjects since the time of Edward I., are now held of the crown. A freehold estate must be an estate in fee, in tail, or for life; all other estates in land, as estates for years, are called chattel interests. An estate of freehold could in general be created only by livery of sasine of feoffment (q.v.). By the doctrine of the feudal law, no person who had an estate of less duration than for his own life or for the life of another man, was considered to be a freeholder; and none but a freeholder was considered to have possession of the land. A tenant for years, etc., was regarded as holding possession for the freeholder. The possession of the freeholder might, however, be defeated by the wrongful act of the tenant; for a transfer of possession or livery of sasine by the tenant would divest the freeholder and leave him to his right of entry (q.v.). This effect of a feoffment by wrong was abolished by 8 and 9 Vict. c. 106, s. 4. Before the time of Henry VI., all freeholders were entitled to vote on the election of a knight of the shire, as they still may for the appointment of coroner. But by 8 Hen. VI. c. 7, the famous statute was passed which still in great measure regulates the county elections, and enacts that no freeholder shall vote whose freehold is not of the value of at least 40*s*. a year. By 2 Will. IV. c. 45, s. 18, this qualification is continued as to all freeholds of inheritance, and to freeholders for life in actual occupation, or who have acquired their lands by marriage, marriage settlement, devise, or promotion to any benefice or office.

FREEHOLD LAND SCHEME had for its object to enable mechanics, artisans, and other classes belonging to the lower classes, to purchase a piece of freehold land, of such yearly value as to entitle the owner to the elective franchise. Irrespective of any political object, benefit building societies now exist in most of the greater towns of this country, and are believed to be of great service to the laboring man. See BENEFIT SOCIETIES.

FREE-LANCES were roving companies of knights and men-at-arms, who, after the crusades had ceased to give them employment, wandered from state to state, selling their services to any lord who was willing to purchase their aid in the perpetual feuds of the middle ages. They played their most prominent part in Italy, where they were known as condottieri (q.v.).

FREEMAN, EDWARD AUGUSTUS, b. England. He was elected scholar of Trinity college, Oxford, in 1841, fellow in 1845, filled the office of examiner in the school of law and modern history in 1857–58 and in 1863–64, and in the school of modern history in 1873. In May, 1872, he delivered the Rede lecture at Cambridge, the subject being *The Unity of History*. He has written much on historical, political, and architectural subjects, and is the author of *A History of Architecture*; *The Architecture of Llandaff Cathe-*

dral; an *Essay on Window Tracery; The History and Conquest of the Saracens; The History and Antiquities of St. David's*—the latter conjointly with Dr. Basil Jones, the present bishop of St. David's; *History of Federal Government; History of the Norman Conquest; Old English History; History of the Cathedral Church of Wells; Growth of the English Constitution; General Sketch of European History; Historical Essays; Comparative Politics; Disestablishment and Disendowment, what are they? Historical and Architectural Sketches, chiefly Italian;* and *The Ottoman Power in Europe, its Nature, its Growth, and its Decline.*

FREEMAN, James, d.d., 1759–1835; b. Mass.; graduated at Harvard, and in 1782 was a reader in King's chapel, an Episcopal church in Boston, and the first of that order in New England. Subsequently he became a Unitarian, and induced the society to alter their prayer-book in accordance with his views. In 1787, he was ordained by his own congregation, and remained rector of King's chapel (now the stone chapel) 48 years. He was a scholarly and philanthropic man, and was one of the founders of the Massachusetts historical society. His was the first Unitarian church in this country, and he was the first minister who openly assumed the name of Unitarian. A volume of his sermons has been published.

FREEMAN, James Edward, a native of Nova Scotia, removed with his parents to the state of New York, and after a youth of hardship became a student in the national academy of design. He became an academician in 1833. Since 1840 he has resided in Rome. His pencil is devoted chiefly to historical subjects and portraits.

FREEMAN and FREEDMAN. In the most general acceptation of these terms, the first implies one who has inherited the full privileges and immunities of citizenship: the second, one who has been delivered from the restraints of bondage, but who, usually, is not placed in a position of full social or even political equality with him who was born free. Though the words are Teutonic (being composed of *frei*, free, and *mann*, a man or human being), the distinction between them depends on the constitution of Roman society. The equivalent for freemen (*liber homo*), indeed, comprehended all classes of those who were not slaves; but the distinction here pointed out was preserved by the application of the term *ingenuus* to him who was born free (Gaius i. 11), and of *libertinus* to him who, being born in servitude, was emancipated. For the further development of this subject, as regards the classical nations of antiquity, see Slavery, Citizen. As the organization of Roman society survived the convulsions of the middle ages to a far greater extent in the towns (see Municipality, Municipal Corporation) than in the landward districts, where the institutions of feudality almost entirely superseded it, it is in the borough and other municipal corporations of this country, and of continental Europe, that we still find *freemen*, or persons inheriting or acquiring by adoption, purchase, or apprenticeship, the rights of citizenship. See Freeman's Roll. But the idea of a freeman was by no means peculiar to the Roman or Romanized population of Europe; on the contrary, it belonged to the constitution of society in all the Indo-Germanic nations. Amongst those branches of them commonly known as Teutonic, it was generally based on the possession of some portion of the soil. In Anglo-Saxon England, the freemen were divided into ceorls (q.v.) and eorls (q.v.), or thanes (q.v.). See Citizen.

FREEMAN'S ROLL. By 5 and 6 Will. IV. c. 76, commonly called the municipal corporations' act, which placed the corporate towns, or, as they are denominated, the boroughs enumerated in the schedules A and B—i.e., nearly all the boroughs in England and Wales except London—under one uniform constitution, a distinction is made (s. 2) between the F. R. and the burgess roll. Every person who, if the act had not passed, would, as a burgess or freeman, have enjoyed, or might have acquired, the right of voting in the election of members of parliament, is to be entitled to enjoy or acquire such right as heretofore. And it is further enacted (s. 5), that the town-clerk of each borough shall make out a list, to be called *the freeman's roll*, of all persons admitted burgesses or freemen, for the purpose of such reserved rights as aforesaid, as distinguished from the burgesses newly created by the act, and entitled to the rights which it newly confers; these last are to be entered on another roll, to be called the *burgess roll.* See Burgess.

FREEMASON, Freemasonry. See Mason; Masons, Free.

FREE METHODISTS. See Methodists, Free (Methodists, *ante*).

FREE PORT (Ital. *porto franco*) is a harbor where the ships of all nations may enter on paying a moderate toll, and load and unload. Free ports form depots where goods are stored at first without paying duty; these goods may then be either reshipped for export on paying a mere transit-duty, or they may pay the usual full customs of the country, and be admitted for home consumption. Free ports thus facilitate transit trade, and form, as it were, a foreign district within a state. See Warehousing System.

FREEPORT, a city and seat of justice of Stephenson co., Ill., on Pecatonca river, and the Chicago and Northwestern and Illinois Central railroads, 121 m. w. of Chicago;

pop. '70, 7,889; in '80, 8,521. It is the seat of Freeport (Presbyterian) college; has a fine court-house, manufactories of reapers, wagons, carpets, machinery, etc. The place was first settled in 1835.

FREE RELIGIOUS ASSOCIATION, established in Boston in May, 1867, declaring its objects to be to promote the interests of pure religion, to encourage the scientific study of theology, and to increase fellowship in the spirit. Members are responsible only for their own opinions, and these do not affect their relation to other associations. Any one may be a member, but to be entitled to vote a small annual fee is required. At the annual meetings members of several denominations have participated, though its influence is regarded as adverse to the doctrines known as evangelical.

FREE-SOILERS, the name of a political party in the United States, which began to be prominent about 1846, rose to much importance during the Kansas-Nebraska struggle, and became merged into the republican party in 1856. The "Wilmot proviso," offered in 1846 by David Wilmot, a democratic member from Pennsylvania, to a bill in congress making an appropriation to negotiate peace with Mexico, was the standpoint of their party. This famous proviso reads: "that there shall be neither slavery nor involuntary servitude in any territory on the continent of America which shall be hereafter acquired by or annexed to the United States by virtue of this appropriation, or in any manner whatsoever, except for crime." The proviso passed the house, but failed in the senate. In both the whig and democratic national conventions in 1846, this proviso or its substance was introduced into the party platforms: in both it was rejected, and many prominent northern men, of both parties, seceded. In New York, these seceders were chiefly from the democratic party, and were known as "barnburners" (q.v.). The free-soilers held a national convention at Buffalo in 1848, and nominated ex-president Van Buren as president. The ticket was presented in 13 states, obtaining an aggregate of 291,363 votes out of 2,871,908; but it carried no electoral vote. In 1852, John P. Hale was the candidate of the free-soilers for president, but his vote was only 156,149 out of 3,144,201. In New York alone, nearly 100,000 "barn-burners" had disappeared, by far the greater portion returning to the regular democratic party. In the next vote for president (1856), a considerable number of free-soilers went with the native Americans, but the greater portion sided with the newly-formed republican party, and from that time the free-soilers have not formed a distinctive party.

FREE-SPIRIT, BRETHREN OF THE, a fanatical sect of the middle ages, which was very generally (though sometimes secretly) diffused over Italy, France, and Germany, between the 13th and 15th centuries. They took their name from the "freedom of spirit" which they claimed, in virtue of the words of St. Paul (Romans viii. 2, 14), maintaining that the true sons of God are exempt from subjection to the law. They appeared first in Alsace, in the early part of the 13th c., and attracted notice by their singular attire and their fanatical proceedings, traversing the country in troops, accompanied by women, with whom, under the name of sisters, they lived in the greatest familiarity. Their doctrine was a species of pantheistic mysticism, which they applied with fearless consistency to all the details of the moral obligations. They held, according to Mosheim, who has collected the original authorities, "that all things emanate from God, and will revert back into him; that rational souls are part of the divine being; that the whole universe is God; that a man, by turning his thoughts inward, is united inexplicably with the First Cause, and becomes one with him; and that those who are so immersed in the vortex of the Deity attain to perfect freedom, and are divested not only of the lusts, but even of the instincts of nature." From these principles, they inferred that the free man, thus absorbed in God, is himself God, and a son of God, in the same sense in which Christ is called the Son of God; and that, as such, he is raised above all laws, human and divine; to such a degree that, according to some of them, "the godlike man cannot sin, do what he may; either because the soul, being elevated and blended with the divine nature, is no longer affected by the actions of the body, or because the emotions of the soul, after such union, become in reality the acts and operations of God himself, and therefore, though apparently criminal, and contrary to the law, are really good and holy because God is above all law! These blasphemous and immoral principles, incredible as they may appear, are extracted by Mosheim, partly from the books of the sect, partly from the decrees of Henry, archbishop of Cologne, by whom they were condemned. Principles such as these drew down upon the sect the arm of the state, as well as the censures of the church. No sect of the time suffered so much from the inquisition in the 14th century. They were regarded as offenders against public order and morality, as well as against the faith of the church. See INQUISITION. After the first appearance of the sect in Alsace (1212), where its leader was a certain fanatic called Ortlieb (after whom the members are sometimes called Ortliebians), it spread into Thurgau and the upper and lower Rhine. During the latter part of that century, one of the leaders, named "Meister Eckart," had so large a following at Cologne, that the archbishop made his teachings the subject of a lengthened edict. The sect spread also in Suabia, where its members were confounded with the Beghards. In France, they were popularly known by the name "Turlupins," a word of uncertain etymology. We meet them in Bohemia in the beginning of the 15th c., and there is considerable similarity between their principles and those of the Adamites, who figure in Hussite history.

From this date they are heard of no more.—See Mosheim, Soames's ed., ii. 582; also Gieseler's *Church History*, iii. 467, iv. 226.

FREE STATE, ORANGE. See ORANGE RIVER FREE STATE.

FREE'STONE, any rock which admits of being *freely* cut and dressed by the builder. In Scotland, it is synonymous with sandstone. It has also been defined as any rock which works equally freely in every direction, having no tendency to split in one direction more than another. In this sense, limestone and even granite have been called freestones.

FREESTONE, a co. in n.e. central Texas, on Trinity river; 900 sq.m.; pop. '70, 8,139—3,368 colored. The surface is hilly or undulating, and the soil is fertile. Productions, corn, sweet potatoes, and cotton. Co, seat, Fairfield.

FREETHINKERS, a name first given to the English deists of the 16th and 17th centuries, and now very often applied indiscriminately to those who for whatever reasons reject Christianity as popularly understood and expounded. Like the names Quaker, Methodist, and even Christian, it is probable that it was first used as a term of reproach, but accepted afterwards by many of those to whom it was applied as an honorable and truly descriptive term. It is not in general use in the United States, the rejectors of evangelical opinions being more generally called skeptics, rationalists, or infidels. There is, however, a considerable number of people in this country who call themselves freethinkers, and who meet in conventions thus designated for the promotion of certain avowed objects. This class of persons are averse to religion in every form, as an invention of priests, and a superstition to be wholly discarded. They are without faith in God or in a future life. They do not take offense when called infidels, professing to regard the name as an honorable one. With some, at least, of this school, freethinking is accompanied by laxity of morals, in practice as well as theory, though the name does not necessarily imply this, and is often used in a different sense. While the various classes of unbelievers have much in common, they are in many respects widely divergent from each other in their views; some being atheists, and some theists; some materialists, and some believers in the spiritual nature of man and in the immortality of the soul; some holding the Bible in contempt as an instrument of priestcraft, and others valuing it highly on moral and spiritual as well as literary and historical grounds; some seeking to free religion from what they hold to be errors and superstitions, and others to destroy it altogether. To call these different classes by any name implying unity of belief on these several topics would be alike misleading and unjust. Of course, Christians of whatever sect profess to have formed their opinions in the exercise of true freedom of thought; but the name of freethinkers, in common usage, is not applied to them, but to the class of persons above described. Among the chief English freethinkers we may name Hobbes, Hume, Bolingbroke, and Herbert. They and their associates were neither atheists nor materialists, but theists or deists (though these two names are not strictly synonymous). They professed, probably with sincerity, a desire not to destroy religion, but to emancipate it from formalism and dogmatic authority. Lord Herbert, one of the most eminent of their number, avowed his belief in the existence of one supreme God, the duty of worship, piety, and virtue, the efficacy of repentance and the existence of rewards and punishments in this life and the next. Such men would hardly be called freethinkers now. The freethinkers of France, who were the precursors of the great revolution, were of a somewhat different stamp, less thoughtful and more aggressive, especially towards the despotism of church and state. The most eminent freethinker who has lived and written in the United States was Thomas Paine, author of the *Age of Reason*. He is not, however, a fair specimen of the class, morally. See INFIDELITY, RATIONALISM.

FREE-TOWN—a name of the same significance as the *Liberia* of American origin to the s. of it—the capital of Sierra Leone, a British settlement on the w. coast of Africa. It is situated on the left bank of the Sierra Leone river, about 5 m. from the sea, in lat. 8° 29′ n., and long. 13° 9′ west. Pop. about 16,000. The town is pleasantly situated, and its wide streets are prettily ornamented with rows of orange, lime, banana, or cocoanut trees. The temperature, as one may expect from its locality, is tolerably uniform, varying in opposite seasons between the averages of 77°.6 F. and 80°.9. Towards the interior, Free-Town is inclosed by the mountain-chain from which the colony is designated, a position to which the proverbial insalubrity of the climate is partly owing. The population, exclusive of the authorities and the garrison, consists almost exclusively of liberated negroes.

FREE TRADE. This term, when used so late as 30 years ago, expressed a disputed proposition, and was the badge of a political party; it now expresses the most important and fundamental truth in political economy. From its simplicity, it affords, to those who expect to make political economy an exact science, the hope that they have obtained at least one axiom. But it has in reality been established as the result of a double experience—the one being the failure of all deviations from it, the other the practical success of the principle during the short period in which it has been permitted to regulate the commerce of this country.

Trade consists in buying and selling. There is F. T. where there is no interference

with the natural course of buying and selling, if such interference be intended to improve or otherwise to influence trade. It is necessary to keep this distinction in view, because there are many laws not contrary to the spirit of F. T. which interfere with buying and selling; for instance, in this country, it is unlawful to deal in slaves, because we do not acknowledge the right of one human being to be the owner of another; it is unlawful to sell intoxicating spirits without having obtained a license, because the tax for the license brings revenue to the exchequer, and intoxicating liquors are a commodity which it is advisable to tax, in preference to the common necessaries of life, or even harmless luxuries. There are many of these last which cannot be sold into this country without paying customs duty, but this is for the purpose of revenue merely, not as a restraint on trade.

The many attempts made by governments to regulate trade for the purpose of benefiting the communities over which they ruled, may be divided into two great classes: the one prohibited the exportation of commodities, the other encouraged exportation, and prohibited or discouraged importation. The former was the old rule in this and in other countries. It was supposed that the wealth of the country depended on its retaining within itself certain productions of native growth or industry, and their removal out of the country was prohibited or restrained. Until a late period, the exportation of machinery was prohibited; but this was an exceptional remnant of the old principle, which had yielded to its converse, in which it was maintained that exportation is the source of wealth, and importation is a wasting of a nation's substance. On this theory the great body of British commercial and financial legislation, which received its death-blow in 1846, was founded. By it, a commercial community was then likened to an isolated human being possessed of a certain fund which he must of course spend, so as to become so much the poorer, if he buys commodities, which to him is equivalent to a nation's importing them. The notion was founded on the analogy of the miser, who will, of course, increase his store by restricting his purchases. Communities, however, are not in the position of the miser, possessing separate capital, which he can protect and increase; they rather resemble the merchant who buys and sells, making a profit on what passes through his hands. Whatever communities import, they pay for by exports. This can be shown by analysis in any class of national transactions. If we pay for the goods we import by bills of exchange, these bills represent goods exported, otherwise they would not be paid. See EXCHANGE. If we pay for goods in bullion, it is the same thing; gold does not grow in this country, and every sovereign we send abroad to pay for goods has been got as the price of goods exported, unless it have been brought by any of our own people from the gold districts, and then it is virtually a produce of British industry. It is, in fact, a sort of dynamic law that importation causes exportation, just as a vacuum in physics is filled up by air, or the other nearest fluid.

As applied to the individual inhabitants, and not to the nation, F. T. is the right of every man to do as he pleases with his capital and abilities; and as the general desire of mankind is to improve their condition, and, in fact, the greater portion of them are thoroughly devoted to this pursuit, the interests of the nation at large cannot be in better hands than in those of men who, by increasing their own wealth, are increasing the wealth of the public. The progress made by this country since 1846, has afforded a wonderful experimental illustration of this truth, since the exports have been tripled. They were, in round numbers, 40, and are now 120 millions. For more particular facts and circumstances connected with the establishment of F. T., see ANTI-CORN-LAW LEAGUE, CORN LAWS, CUSTOMS.

FREE TRADE (*ante*), a phrase which, as generally used in the United States, signifies an exchange of commodities between the people of different countries, without any restriction on the part of the government, except so far as it may be thought expedient and necessary to impose a tariff upon foreign goods solely for the purpose of raising revenue. A tariff imposed for the protection or benefit of home manufactures is held by free-traders to be contrary to sound principles of political economy, and therefore, in the long run, injurious to the nation which imposes it. The argument for free trade as thus defined may be briefly and fairly summarized as follows: The imposition of duties upon foreign productions in order to enhance their price and thus to create or foster a market for home productions of the same kind, is in the nature of a tax upon consumers for the benefit of producers, and therefore unjust, it being the right of consumers to buy in the cheapest market. A country which puts no hindrances on imports always deals to the greatest advantage, and that advantage decreases in proportion as restraints are imposed. To prohibit men by law from buying where they can buy cheapest, is to affirm in effect the principle of human slavery, and to erect a barrier against the progress of civilization. Such prohibitions, moreover, by creating an artificial stimulus to home production, often lead to a ruinous competition, resulting in overproduction and loss of capital. Governments should leave men free, without interference, to employ their capital and labor according to their own individual judgment and enterprise, and the exchange of productions between nations should follow the natural laws of political economy. Protection, so-called, is an interference with the laws of nature. Any temporary advantages gained by this means are more than counterbalanced by inevitable evils. The protection of a special production is only temporary,

while it does not result in any benefit whatever to the general industry of a nation. Individual enterprise and self-interest are better guides in the investment of capital than legislative enactments. A nation can attain to the highest prosperity and secure the greatest abundance for its inhabitants, not by restrictions upon trade, but by making it absolutely free. Every nation should devote itself to such branches of industry as are best adapted to its soil, climate, and circumstances, and exchange its productions for those of other nations according to the economic laws which exist in the nature of things. The argument that if trade is left thus unrestricted, the opportunities for the employment of home labor will be diminished, is akin to if not identical with that which has so often led men to oppose the introduction of labor-saving machinery. When any trade or manufacture can be profitably introduced into a country, private enterprise is adequate to the purpose, and is the only agent that can be safely relied upon. Protective duties, to be effective, must operate partially, unequally, and therefore unjustly. Protective legislation is always fluctuating and uncertain, while freedom of trade, once established, contributes to the stability of both capital and labor. It is an important argument for free trade that it tends to promote peace and diminish the incitements to war. It promotes friendliness between nations through the sense of interdependence and a community of interests. A vast proportion of the wars that have cursed the human race have grown out of the irritations caused by restrictions upon commercial intercourse. It was formerly supposed that in the commerce of nations what benefited one must of necessity injure another; but this absurdity has been effectually exposed. It is now clearly seen that trade between nations as between individuals is mutually advantageous, and that in keeping open and unobstructed the highways of commerce the brotherhood of the human race is promoted. Foreign trade in its nature differs from the trade at home, and the one no more than the other can be promoted by legislative interference. Those who wish to see the doctrine of free trade thoroughly expounded by its ablest champions are referred to the works of Mill, Macleod, Amasa Walker, Perry, and others; also to Bastiat's *Sophisms of the Protectionists*, and Grosvenor's *Does Protection Protect?* (For the argument against free trade and for protection, see TARIFF.)

FREE-WILL. The freedom or liberty of the will is the designation of a doctrine maintained in opposition to another doctrine, expressed by the term "necessity." The contest between those two views has been maintained in the fields both of theology and of metaphysics. The idea of a man being "free" in his actions appears first in the writings of the ancient Stoics. Afterwards in Philo Judæus, an Alexandrian Platonist, who flourished at the commencement of the Christian era, there occurs an inquiry propounded, "whether it be not the case that the upright man is free, and the vicious man a slave." This language was evidently meant to pay a compliment to virtue, and to affix a degrading stigma on vice, and ought not to have been too literally interpreted; for in strictness it might have been maintained, with even greater plausibility, that the vicious man, who defies all the restraints of society, has the greater liberty of the two. The doctrine of freedom, as applied to the human will, was first contended for by Pelagius against Augustine's doctrines regarding the operation of grace; and in a later age was the subject of controversy between Arminians and Calvinists, the Calvinists (such as Jonathan Edwards) having usually been Necessitarians.

Although in this dispute there are certain points of real difference of opinion between the opposing parties, yet the problem has been unnecessarily encumbered with the unsuitable phraseology that has accidentally invested it. The notion of "freedom" is intelligible when we speak of a free man as opposed to a Russian serf, or of a free press as opposed to censorship; but with reference to human actions generally, it has no particular relevancy. When a man, urged by hunger, eats the food that is before him, we recognize two separate facts, the one leading to the other: the first is a painful feeling or sensation, the other a series of movements by which food is conveyed to the system; the one fact we call the motive, the other the action, of the will following on the motive; but there is no propriety in describing this sequence as either free or not free. We may inquire into the greater or less certainty of the sequence—namely, whether a hungry man does always, as a matter of course, avail himself of the food presented to him, or whether one may be very hungry with the option of eating, and with no other motive operating to deter from the act, and yet not eat, thus showing an absence of uniform connection between pain and the movements for alleviating it; this would be a *real* question, and would throw light on the actual constitution of the human will; the question of liberty and necessity does not present us so much with an intelligible question as with an artificial difficulty made by inapplicable phraseology. It would have been much the same to have disputed whether or not the will is rich, or noble, or royal, merely because the virtuous and right-minded man has sometimes been commended by those epithets being applied to him. The word "necessity," also, is ill chosen, in consequence of its great ambiguity; being applied sometimes to logical and mathematical implication, as when we say the whole is greater than its part; sometimes to the rigorous uniformity of physical laws, such as gravitation; and at other times to what is merely a high probability, as when we expect that a man of honorable and upright character will speak the truth on some given occasion. See NECESSITY.

If we cast aside these confusing phrases, and inquire what is the real matter of dispute, we shall find that there are intelligible differences of opinion in reference to the sequences of human volition. It may be maintained that our actions have the same uniformity as the successions of the physical world; and this view would be supported by a very wide induction of experience. It will be found that the whole of the complicated operations of society depend upon the certainty that men, in the same circumstances and under the same motives, will act in the same way. We allow for differences of individual character; but when once we have seen what any man is disposed to do in one instance, we take for granted that he will be similarly actuated when the identical circumstances are repeated. The whole of our trading operations are founded on the maxim that human beings prefer a greater to a smaller gain; and it has never been found that any portion of our race has taken a wayward fit, and contradicted itself on this point. We are prepared for exceptions to the rule, when other strong motives are present, but these are merely the intervention of a new force, not the suspension of the law that connects the other motive with its usual consequent. Nor is there anything degrading to human nature in this uniformity; while the opposite state of things would undermine all the securities of human life, and land us in a moral chaos. If human beings, who habitually dread pains and penalties, were suddenly, for no ulterior reason, to court hunger and cold, imprisonment and disgrace, it is obvious that there would be a speedy termination of man's career on the globe.

Still, the position thus contended for may be, and has been, called in question; or, at least, certain exceptions to its universality may be put forward. We are able to comprehend the meaning of this counter-doctrine, even although we may find a difficulty in acceding to it. For example, Socrates drew a distinction between *human* and *divine* knowledge, intending by the one the departments of nature where strict law prevailed, and where by assiduous observation men might attain to certainty; such was the knowledge of the operative respecting his special craft, in which it was absurd to seek for any other source of insight than his own and other men's experience. But this did not include all knowledge. There was a department, the divine, reserved by the gods for their own special administration, and where they did not bind themselves to observe uniformity of dealing. This region included, according to Socrates, such great operations of the physical world, as the motions of the heavenly bodies, the phenomena of weather and season. To be enlightened on these, it was necessary to consult the gods by oracle and sacrifice. Now, applying this view to the case of the human will, it might be maintained that, in the greater number of instances, and in all matters of primary importance, such as self-preservation, the uniformity of human actions must be admitted; but still there may be some deep, subtle, and refined operations, where the same motives sometimes lead one way, sometimes another, the whole situation being in every other respect identical. But it lies with the supporters of this view to substantiate their exceptional cases in the midst of so much evident uniformity. As yet, nothing of the kind has ever been proved, and our only safe ground, philosophically, is what is our safe ground practically—namely, to abide by the doctrine of law in *all* human actions, on which we have not the smallest scruple as respects the preponderating mass of them.

The partisans of liberty, who take up the ground of opposition to uniform law as now expounded, not unfrequently express themselves to the following effect. Granting that the emotions of the mind have a uniform efficacy as motives, and that he that has a musical taste will be found on all occasions acting in conformity with it, still the emotions are not the whole of the mind. We have, in our mental composition, feelings, and intelligence, and activity; but these do not make up our entire being. There is a something that all these inhere in, a substratum or support, which we call our "self," the "ego," or "I," and this abstract self is exempt from the conditions that attach to these attributes of self. This ultimate personality of every human being is free and independent, being exempt from the laws whereby our several feelings operate as motives to our ordinary actions. A self-determining power is supposed to reside here, even if excluded from the other mental adjuncts. It is considered unphilosophical and incorrect to resolve the whole of mind into feelings, actions, and intellect; these are mere attributes of an inexplicable something which each one is conscious of, and recognizes as the essence or center of the mental being, while they are merely properties or attributes. Granting the existence of this inner self, there is said to be sufficient scope for a properly free agency, without going the length of supposing that men are to contradict themselves in the everyday conduct of life.

Such a mode of stating the doctrine of liberty, however, is liable to the charge of logical confusion, not to speak of the difficulty of establishing the existence of the entity in question. If we were to inquire into what constitutes the *essence* of mind, the thing which being present constitutes mind, and whose absence is the negation of mind, we might perhaps not be able to come to a conclusion that all philosophers would acquiesce in. It is always reckoned a very abstract and metaphysical discussion to settle the essence of things; even as regards *matter*, this is not an easy question. But if "essence" is to mean something, and not absolutely nothing, it must point to some power, property, or quality, capable of being named and signalized. Thus, we might say the essence of material bodies is the quality variously named, as resistance, momentum,

inertia; all which imply that one body is at once an obstruction to other moving bodies, and a moving power when once in motion; but if any one insists that this is but one of the attributes of matter, in common with weight, extension, color, etc., and that there must be something still deeper, in which all the various qualities inhere, we can only answer that we know of no such essence or substratum, and are incapable of conceiving any such. We may fix upon the most fundamental, the most universal, and inerasable quality of a thing, such as this property of resistance as regards material bodies, and term that the essence; while any other attempt at discovering an essence would only end in setting up fictions. So in the case of mind. If we are called on to specify any one aspect of our mental constitution more universal and fundamental than the rest, with a view to setting forth the essence of mind, we should be obliged to select VOLITION, or action governed by feeling, as the main or central fact. Wherever we can prove the existence of feeling, and of an activity controlled by that—as when an animal uses its organs to preserve its own life, to cater for pleasures, and ward off pains—we should have to admit the reality of mind, although, perhaps, the intelligence were of the lowest kind. Any being not possessing both sensibility and the power of acting in accordance with it, could not be said to possess a true mental nature. We should not trouble ourselves with considering the possible existence of a mystical "ego," but should at once declare that such a being did not come up to the standard of definition of mind. Will, or volition, as thus explained—namely, the direction of the active organs of a living creature to chime in with its various feelings—is itself the essence or substratum of mind, as resistance is the essence of matter. Wherefore, to speak of feelings and actions as something apart from the "ego," but inhering in it, is merely to count the same fact twice over, or to call a thing the attribute of itself. Volition *is* mind, and not an attribute of mind; and when we have specified the power of voluntary, or feeling-guided action, and a certain amount of intelligence, varying greatly in individuals, we have specified everything that can belong to any individual man or animal; an "ego" beyond this is something inexplicable and fictitious. It cannot, therefore, be admitted that any foundation is given to a supposed "free agency," by referring to this occult and imaginary essence, any more than it would be competent to claim exceptions to the great physical laws that govern material bodies, by assuming an occult essence of matter with powers and properties at variance with its inertia, weight, extension, and other known qualities.

In one respect, the mind is differently situated from the material world in all that regards the power of tracing strict uniformity, and predicting the future from the past. Each one of us has direct access to our own feelings, but only an indirect and imperfect access to the feelings of another person. Excepting self, we can never know the whole of what any one feels; our best observations and reasonings are but approximations to the truth, and predictions founded on them are liable to be falsified through unseen forces in the arcana of another man's individuality. Admitting the uniformity of sequence of motive and act, we are never able to exhaust the motives of any single mind, beyond our own; and thus each one may be said to move in a certain inner circle of the impenetrable and unpredictable, while the large mass of the everyday actions of all human beings follows an almost undeviating regularity. This is a very important distinction between mind and matter, although not invalidating the great general fact of uniform law, as attaching to the one no less than to the other. For a sketch of the history of this great controversy, see Dugald Stewart's *Active Powers*.

FREEWILL BAPTISTS. See BAPTISTS, FREEWILL.

FREEZING AND FUSING POINTS. See FUSING POINTS.

FREEZING MIXTURES, AND OTHER MEANS OF COOLING. When matter passes from the solid into the liquid state, heat in large quantity disappears, and ceases to affect the thermometer. See HEAT. The chemist avails himself of the fact that heat disappears during liquefaction, for the purpose of procuring artificial cold. When a piece of ice having a temperature of 32° F. is placed in its own weight of water at 174°, we find, on testing the water with the thermometer after the ice has melted, that its temperature is 32°; the heat which the water contained having disappeared during the melting of the ice. As water in passing from the solid to the fluid state possesses the property of rendering latent a greater amount of heat than any other substance, it is, when in a solid form, as ice or snow, or when combined with salts, as water of crystallization, a powerful agent in producing artificial cold.

The substance employed in freezing mixtures should be finely powdered, rapidly mixed, and placed in vessels with little conducting power. The following are a few of the important formulæ for these mixtures: 1. A mixture of 2 parts of pounded ice or of fresh snow and 1 part of common salt, causes the thermometer to fall to − 4°. 2. A mixture of 5 parts of commercial hydrochloric acid and 8 parts of powdered crystallized sulphate of soda, causes a reduction of temperature from 50° to 0°. 3. Equal parts of water, of powdered crystallized nitrate of ammonia, and of powdered crystallized carbonate of soda, produce a cold of − 7°. 4. A mixture of 3 parts of crystallized chloride of calcium, previously cooled to 32°, and 2 parts of snow, produces a cold of − 50°, which is sufficient to freeze mercury. 5. By dissolving solid carbonic acid, or solid nitrous oxide gas, in sulphuric ether, temperatures of from − 120° to − 146° may be

obtained, at which alcohol passes to the consistency of oil, and finally to that of melted wax. This is the most powerful freezing mixture that is known.

The freezing mixtures used by confectioners and those that are most convenient for ordinary experimental purposes, are the first and second of the above list.

When matter passes from the liquid to the aëriform state, heat also disappears, and the knowledge of this fact has been applied to the cooling of liquids, and to the actual production of ice. If a glass bottle containing water be covered with a cloth, which is kept constantly wet by the application of water, the evaporation from the wet cloth will soon diminish the temperature of the contents of the bottle, and if the cloth were moistened with alcohol or with ether, the cold would be proportionally greater, the degree of cold varying with the rapidity and extent of the evaporation. Wine-coolers, or water-coolers, made of porous earthenware, act in the same manner as the cloth. They are soaked in, and saturated by water, which by its evaporation occasions cold. Coolers of this kind are common in most hot countries. On the ancient monuments of Egypt, a man is sometimes represented as fanning these vessels with a palm-leaf, to promote evaporation, and the Arabs in that country still practice this custom. See REFRIGERATING MACHINES.

In some parts of India, where the dryness of the air allows a considerable evaporation to take place, ice is obtained in the following manner: "Flat, shallow excavations, from 1 to 2 ft. deep, are loosely lined with rice-straw, or some similar bad conductor of heat, and upon the surface of this layer are placed shallow pans of porous earthenware, filled with water to the depth of 1 or 2 inches. Radiation (see HEAT) rapidly reduces the temperature below the freezing-point, and ice is formed in thin crusts, which are removed as fast as they are produced, and stowed away in suitable ice-houses."—Miller's *Elements of Chemistry*, 2d ed., vol. i. p. 220.

FREEZING MIXTURES, AND OTHER MEANS OF COOLING (*ante*). In general, it may be said that artificial freezing is effected by three methods, that of liquefaction by mixtures, that of the expansion of vapors escaping from volatile liquids, and that of the expansion of compressed air. Before giving a description of ice-making machinery, we refer to the fact that water has more capacity for heat than any other substance, and therefore, for the purpose of cooling substances to moderately low temperatures, such as procurable water may have, that substance will be found the most economical. The freezing of water by rapid evaporation was long ago performed by means of the air-pump; sir John Leslie having, in 1810, succeeded by the use of sulphuric acid, placed alongside the water in the receiver for the purpose of removing the vapor which would otherwise recondense on the descent of the piston. The experiments of Faraday, about 15 years later, with sulphurous acid are also familiar to those who have witnessed class room experiments. All these operations were on a small scale, and not till about 1850 was there anything like a commercial application of ice-making machinery. The beginning of such machines was made by an American, Jacob Perkins, who patented his invention in England, 1834. The apparatus consisted of a flat vessel containing ether, immersed in a vessel containing water, or any substance to be cooled. Vapor of ether was exhausted from this vessel by means of an air-pump, and again recondensed by forcing it through a coil of tube immersed in cold water, by the action of the same pump; and then forced, liquefied, into the original vessel. This answered the purpose of a domestic refrigerator, but was not an ice-producing apparatus. Perkins had many imitators, especially in France. Only one of these, however, made any advance; this was the apparatus of Bourgois, patented in 1846 for the use of hydrocarbons as the volatile liquids on the principle of Faraday's discovery 20 years before. The first important step towards any commercial results in the practical manufacture of ice was by another American, Alexander C. Twining, LL.D., professor of mathematics and natural philosophy in Middlebury college, Vt., in 1848 and 1849, and whose English patent was dated July, 1850. It was a re-invention of the Perkins apparatus in many respects, but, it is stated, without any knowledge of it. In many of its arrangements, especially that for the application of the cold and the use of steam-power, it was original. The fundamental patent was taken out in the United States in 1853; but the first ice-machines were made at Cleveland, O., in 1850, and from that time to 1856, machines were made capable of turning out a ton of ice in a few hours, 6 in. in thickness. In 1856, James Harrison patented machines in London, and put them into use both in England and in Australia. Their construction was similar to that described in Twining's fundamental patent of 1853, and quotations from that patent apply to the description of one form of Harrison's apparatus. The success obtained with the above-mentioned machines stimulated Ferdinand P. Carré, of Paris, to invent ice-making machines, which were at first little else than a repetition of the American machine, but afterwards really resulted in the perfecting of apparatus which was operated without any mechanical power. This improvement was the result of the use of aqua ammonia as the volatile liquid, the vapor of ammonia having such peculiar affinities for water, that by an ingenious and simple contrivance mechanical power could be dispensed with. Carre's apparatus is worked in the following manner. A wrought-iron boiler capable of resisting a pressure of ten atmospheres is connected by a tube with a freezing-chamber having two concentric compartments, the outer one connected with the boiler, and the inner

containing the vessel holding the article to be frozen. The freezing-chamber is placed in a cold bath, and to the boiler, into which has been poured a quantity of a saturated solution of ammonia, sufficient heat applied to create a pressure of about six atmospheres, which expels the gaseous ammonia and forces it into the outer compartment of the freezing-chamber, where, by its own pressure and the action of the cold bath in which the chamber is placed, it is condensed in about one tenth of its weight of water. A gauge connected with the condenser indicates when enough ammonia has been condensed, and then the boiler is cooled in a bath. The substance to be frozen is now placed in the inner chamber (the condenser, till now), when the cooling of the boiler removes the pressure which till now has held the ammonia in solution in the inner compartment of the freezing-chamber; and its rapid evaporation in a short time produces an intense cold. Other ammonia machines are used, all constructed on the principle of non-use of mechanical power or effecting vaporization on condensation. The pressure employed in them is from 130 to 180 lbs. per square inch. Rees Reece devised an improvement on Carré's apparatus, which was patented in 1867. A cooler, independent of the boiler, is used to produce evaporation of the condensed ammonia. Variations of these machines are known under the names of the *Atlas, Vaas and Littmann's*, and others. Machines which employ sulphuric or methylic ether, gasoline and other derivatives of petroleum, have two great disadvantages: the tension of the vapors of these fluids is weak, and therefore the evaporation has to be effected by the aid of pumps, and they are also dangerous from liability to explosions. The *Siebe and West* machine, which is of this kind and now in use, has a refrigerator, condenser, air-pump, and ice-making box. *Johnston and Whitelaw's* machine employs bisulphide of carbon in place of ether. *Holden's* machine employs a non-congealable liquid, as a vehicle of cold, it being passed through a pipe in a cylinder where the volatile liquid, as gasoline or chymogene, is evaporated. It is then conducted to the refrigerator, where, in connection with currents of air, it removes the caloric from the water to be frozen. It only remains to mention the air-machines, or those which operate on the simple principle of the expansion of air. Probably the first of this kind was patented (both in England and America) in 1850, by John Gorrie, of New Orleans. The Windhausen machine, in present use, is an improvement upon it. There is no space in this article to describe the working of the apparatus, but an explanation of the general arrangement will probably suffice. The principle of cooling by gaseous expansion, as in the ether and ammonia machines, is employed, and in a similar manner; but instead of a volatile liquid, common air is used. But it must first be compressed, and the more it is compressed the greater and more rapid will be the expansion when the pressure is removed, and therefore the more effective the refrigeration. Compressing the air, however, heats it, and therefore it must be cooled by passing it through pipes surrounded by cold water, or chambers into which sprays of cold water are injected. When it reaches the expansion cylinder it is cooled to nearly ordinary temperature. Here expansion is allowed to take place under various modes, according to the inventor's ingenuity, and the requisite reduction of temperature reduces the water exposed to ice. Kirk's, also Sait's, engines produce ice on the principle of air expansion.

FREEZING-POINT. See THERMOMETER.

FREGENAL' DE LA SIER'RA, a t. of Spain, in the province of Badajoz, and 30 m. s.e. from Badajoz. It stands in a valley among mountains, on the right bank of the Martiga. The streets are wide and well paved, and the houses in general well built. There is an ancient castle, erected by the Templars, within which is the bull-ring, capable of containing 4,000 people. Leather and linen fabrics are extensively manufactured. Pop. 6,000.

FREI'BERG, an ancient city of Germany, the center of administration for the Saxon mines, is situated on the northern slope of the Erzgebirge mountains, on the left bank of the Münzbach, not far from its confluence with the Mulde, 20 m. s.w. of Dresden. It owes its origin to its silver-mines, discovered about the year 1190. It is still surrounded by old walls and towers, and contains many interesting buildings and institutions, of which the principal are the town-house, dating from 1410, and the cathedral (1484 to 1512), two stately Gothic edifices, and the Berg-academie, or school of mines, founded in 1765, the most famous institution of the kind in Europe. At the Berg-academie, instruction is given by professors in surveying, mining, the preparation of ores, geology, mineralogy, etc. It possesses lecture-rooms, a library, and mineralogical and geological collections; and has attached to it three separate laboratories, and an office for the sale of minerals. Humboldt, Werner, Jameson of Edinburgh, and many other eminent geologists and mineralogists, studied at this institution. There are, it is said, about 150 mines of silver, copper, lead, and cobalt around Freiberg. The manufactures consist principally of articles in imitation of gold and silver ware, of white-lead, gunpowder, iron, and copper wares, etc. In the 17th c., it was a place of great wealth, and had a pop. of 40,000. The mines, however, have of late greatly fallen off, owing either to the richest veins being exhausted, or to the shafts being driven so deep that the water cannot be drained off from them. Pop. '75, 23,559.

FREIBURG, a t. of Germany, in the grand duchy of Baden, capital of the circle of the Upper Rhine, is the seat of an archbishop, and is situated on the Dreisam, on the

western border of the Black forest, 42 m. s.s.e. from Strasburg. It is an open, well-built town; the walls and ditches with which it was formerly surrounded, have been converted into promenades and vineyards. The minster or cathedral of F. is one of the most beautiful and perfect specimens of Gothic architecture in Germany. It is cruciform, and built of red sandstone, was begun in 1122, and not thoroughly completed till 1513. It has a tower 367 ft. high, remarkable for its elegance and lightness. In one of its chapels, the university chapel, there are, among other pictures, a Nativity and an Adoration by Holbein, the latter considered one of his most successful pictures. The university of F. was founded in 1456; in 1875, it had 48 professors and teachers, and 318 students. The exchange (*Kaufhaus*) is a quaint Gothic structure of the 16th century. The chief manufactures are chiccory, tobacco, paper, potash, etc. Pop. '75, 30,531, of whom about 2,500 are Protestants.

FREIBURG, or FRIBOURG, a canton of Switzerland, bounded on the n. and e. by Bern, and on the s. and w. by Vaud and the lake of Neuchâtel. It has a superficies of 642 sq.m., and, according to the census of 1876, a population amounting to 113,952, of whom near 100,000 were Catholics. More than two thirds of the inhabitants are French; the remainder are Germans. The official language is French, but all the laws and decrees binding on the whole canton are published both in French and German. The surface of the country is hilly, the mountains in the s. of the canton forming a continuation of the Bernese Alps, and rising in the highest points upwards of 7,000 ft. high. The principal rivers are the Saane or Sarine—which traverses almost the whole extent of the canton from its southern to its northern extremity—and the Broye. The country abounds in excellent meadows and rich pastures, upon which are reared the strongest horses and the best breed of cattle in the whole of Switzerland; indeed, the great part of the wealth of the canton consists in cows, sheep, goats, and horses, of which in proportion to its area there are great numbers. Dairy husbandry, and especially cheese-making, is pursued with great success; 40,000 cwt. of cheese are said to be made yearly. There are considerable manufactures of straw-plat, leather, cherry brandy, and tobacco. F. was received as a member of the Swiss confederation in 1481, and in 1848 a liberal constitution was established. It sends six members to the national council.

FREIBURG, or FRIBOURG, a t. of Switzerland, capital of the canton of the same name, is situated on both banks of the Sarine, but chiefly on a hilly promontory formed by one of its windings, about 18 m. s.w. of Bern. Seen from some distance, the town has a highly imposing and picturesque appearance. Houses climb to the top, and extend to the very edge of the precipice that overhangs the river, and in another portion of the town they form terraces, the roofs of one tier being on a level with the pavement of another; while the whole is surrounded by a long rising and falling line of embattled walls, with watch-towers and gateways of ancient fortifications which still exist in a perfect state. The banks of the Sarine are united by four bridges, one of them a suspension-bridge, 906 ft. long, 23 ft. wide, and 175 ft. above the stream, the longest bridge of a single span in the world—about 300 ft. longer than the Menai bridge. Another suspension-bridge spans the gorge of Gotteron, and is about 700 ft. long, and 317 ft. above the valley beneath. The church of St. Nicholas, a fine Gothic structure, has an organ built by a native of F., which has 7,800 pipes, one of them 32 ft. long, and is considered the finest-toned instrument in Europe. This church has also the highest spire and finest set of bells in Switzerland. The other principal buildings are the cantonal school (previous to 1848 the Jesuits' college), the most conspicuous building of the town; and the Lyceum. The inhabitants of the upper portion of the town speak French; in the lower portion, German is spoken. F. has few manufactures; the chief are woolens, hardware, leather, pottery, and tobacco. Pop. '70, 10,904, of which only 500 are Protestants.

FREIGHT (a word having the same origin as "fare"), the hire of a ship, or part of a ship, for the transport of merchandise; also the merchandise so transported. The agreement for the service is termed a charter-party (q.v.).

If a merchant freight a whole ship, but neglect to fill it, the captain in not at liberty to complete the cargo from other sources, without accounting to the merchant for any moneys received for such additional load. On the other hand, if the merchant covenant to freight a certain portion of a ship, he is bound to pay the sum agreed on for that portion, notwithstanding that his goods may fail to occupy so much space. If, in the charter-party, a day be appointed for sailing, and either the merchant fail to have his goods ready for embarkation by the time fixed, or the vessel be unprepared to start—wind and weather permitting—the agreement may be declared void by the aggrieved party, who can also recover at law for any detriment caused to his property in consequence of the delay. The use of charter-parties has been traced back as far as the reign of Henry III.

This contract, which in England, and generally in the commercial language of this country, is called F., is more commonly spoken of by the legal writers of Scotland as affrightment, from the French *affrètement* (Bell's *Com.*, i. p. 414), but there is no essential difference in the laws of the two countries with regard to it. Throughout the whole commercial world, indeed, in so far as its provisions are not made the subjects of positive stipulation either by charter-party or bill of lading (q.v.), they will be held to be in

accordance with the usage of trade, and of that particular branch of trade to which the hiring has reference.

It was formerly held that the payment of the wages of the crew was contingent on the earning of F. by the ship, in accordance with the maxim of lord Stowell, that "freight is the mother of wages." But this rule, which was already subject to many exceptions, has been abrogated by the merchant shipping act (17 and 18 Vict. c. 104), and wages may now be recovered either by seamen or apprentices, even though no F. has been earned by the vessel. The seaman has a right to cling to the last plank in satisfaction of his wages; but in cases of shipwreck, his claim for wages will be barred if it be proved that he did not exert himself to the utmost to save the ship, cargo, and stores. The provision was first introduced by 7 and 8 Vict. c. 112, s. 17, which enacted that, in order to enable him to recover his wages, the seaman should be bound to produce a certificate from the master, or chief surviving officer of the ship, to the effect that he had so exerted himself. By s. 183 of 17 and 18 Vict. c. 104, the onus of proof is very properly laid on those who impugn the conduct of the seaman. The old rule is still adhered to in America, but it is not applied to the master, and it does not hold with reference to seamen, if the F. has been lost by the fault either of the master or owner; e.g., if the ship has been seized for debt, or for having contraband goods on board. See Kent's *Com.*, iii. pp. 266, 267.

FREIGHT (*ante*), a term formerly applied only to maritime business, such as the hire and use of vessels, but recently extended to goods transported on land, as in railways where there are regular "freight" cars. The term is used to signify also the money or consideration paid for carrying. With regard to freight by ships, the laws in the United States are very nearly the same as in England.

FREILIGRATH, FERDINAND, a brilliant lyric poet of Germany, was b. at Detmold, in the principality of Lippe, 17th June, 1810. He attended the high school in his native town till the year 1825, when he entered a merchant's office, first at Soest, and afterwards at Amsterdam. Encouraged by the favorable reception of his pooms, he abandoned mercantile pursuits, married, and removed to Darmstadt. In 1842, a pension was bestowed upon him by the king of Prussia, whereupon he removed to St. Goar, on the Rhine. This circumstance, and his poem *Aus Spanien*, deprived him of the sympathy of the liberal party, which, however, was restored to him twofold when, in 1844, he gave up his pension, and in his political poems attached himself to the democratic party. The publication of his *Glaubensbekenntniss* (Confession of Faith), in the same year, compelled him to take refuge abroad. He went to Belgium, Switzerland, and in 1846, to London, where he resumed his mercantile pursuits, and became correspondent for the banking-house of Huth & Co. He was about to accept an invitation to America, sent him by Longfellow, when the events of 1848 recalled him to his native country. F. settled in Düsseldorf, where he became the most important member of the democratic party, and sang the praises of democratic socialism. He was impeached on account of his poem *Die Todten an die Lebenden* (The Dead to the Living). The interest felt in this trial was extraordinary. F. was defended by celebrated advocates, who did not fail to ridicule the folly shown in prosecuting a man for writing poetry. The doctrine that the poet is a "chartered libertine" in the expression of his sentiments, carried the day, and F. was acquitted, 3d Oct., 1848. The consequence was inevitable. His poem immediately became the rage; the first edition was sold off in Düsseldorf within a few hours. A second prosecution induced F. again to withdraw from his native country, and from 1849 to 1868 he resided in London. In the latter year, he returned to Germany, and made Stuttgart his home. Several songs, written by him there at the beginning of the Franco-German war, have attained great popularity. F.'s principal productions are his *Gedichte* (1838; 27th ed. 1871); *Ça Ira!* (1846); *Die Revolution* (1848); and *Neuere politische und sociale Gedichte* (1849). Complete editions of his works appeared at New York (6 vols. 1858–59), and at Stuttgart (6 vols. 1870; 2d ed. 1871). F.'s poems display lively imagination, fire, and melody of rhythm, a richness of execution, and a picturesque originality of style, which not seldom, however, passes into eccentricity and merely "spasmodic" force of expression. His translations from English poets are admirable. F. died at Cannstadt, near Stuttgart, on Mar. 18, 1876.

FREIND, JOHN, 1675–1728; an English physician, professor of chemistry at Oxford in 1704. The following year he accompanied the English army to Spain, and wrote an account of the expedition. In 1707, he published a work on chemistry; afterwards became a fellow of the royal society, and of the college of physicians. In 1722, he was in parliament, but being suspected of favoring the restoration of the Stuarts, he was incarcerated in the Tower. There he planned his *History of Physic*, his most important work. From 1725 until his death, he was physician to queen Caroline.

FREINSHEIM, or FREINSHEMIUS, JOHN, 1608–60, b. Germany; a classical scholar and commentator, educated at Marburg and Giessen. He was professor of eloquence in the university of Upsala, and historiographer and librarian to queen Christina. In 1656, he was honorary professor at Heidelberg, where he died. He devoted the greater part of his time to editing and explaining Latin classical authors.

FREIRI'RA, a seaport of Chili, in the province of Atacama, at the mouth of the Guasco. It is a place of some trade. Pop. 10,000

FREI'SCHÜTZ, the free-shooter, is the name given in the legend to a hunter or marksman who, by entering into a compact with the devil, procures balls, six of which infallibly hit, however great the distance, while the seventh, or, according to some versions, one of the seven, belongs to the devil, who directs it at his pleasure. Legends of this nature were rife among the troopers of Germany of the 14th and 15th centuries, and during the thirty years' war. The story first appeared in a poetic form in 1810 in Apel's *Gespensterbuch* (Ghost-book, 1810–15), and F. Kind adapted the story (1843) to the opera composed by Weber in 1821, which has made it known in all civilized countries.

FREI'SING, a t. of Bavaria, is situated in a fruitful, agreeable district on the left bank of the Isar, 20 m. n.e. of Munich. The town was the seat of an episcopal prince till 1802, when the see was secularized. The bishopric of F. dated as far back as 724 A.D., but its bishops were first made princes by the emperor Ferdinand (1619–37). The chief buildings are the palace formerly of the bishop, and a beautiful cathedral, dating from the 12th c., having three naves, two towers, and a singular crypt, the pillars of which have monsters crawling up their shafts. Pop. '75, 8,252, who carry on brewing and distilling, and manufacture vinegar, tobacco, saltpeter, etc.

FREISSER, RICHARD VON; b. Saxony, 1808; educated at Meissen, Göttingen, and Leipsic, and entered a subordinate office in the Saxon ministry of the interior in 1884. On the outbreak of the revolution in Dresden, in 1849, he was appointed provisionally, and afterwards regularly, minister of the interior. He retired in 1852, on account of differences with Von Beust, minister of state, but was made minister of finance in 1859. During the king's absence, in the war of 1866, he was one of the committee intrusted with the government of the kingdom; and on the return of peace, he was minister of foreign affairs. He represented Saxony in the council of the North German confederation in 1867, and in 1870 took an efficient part in the establishment of German unity under the empire.

FRÉJUS (anc. *Forum Julii*), a small t. of France, in the department of Var, is situated a mile inland from the embouchure of the Argens (anc. *Argenteus*) into the Mediterranean sea, and 15 m. s.e. of Draguignan. It was originally a colony from Marseilles, and was afterwards colonized anew by Julius Cæsar, and called Forum Julii. It has remains of ancient Roman walls, and of a Roman circus and viaduct. The ancient harbor, at one time the most important Gallic port, and in which Augustus posted the fleet of 300 galleys which had been captured from Antony at Actium, has become silted up. Here, or rather at the new harbor of St. Raphael, 1½ m. off, Napoleon landed on his return from Egypt in 1799, and embarked for Elba in 1814. Pop. '76, 2,791.

FRELINGHUYSEN, FREDERICK, 1753–1804; b. N. J.; graduated at Princeton college in 1770, and was a delegate to the continental congress in 1775. In the revolutionary war he served as capt. of artillery, and was in the battles of Trenton and Monmouth. He was afterwards promoted to a colonelcy, and served with distinction throughout the war. In 1790, he was appointed maj. gen., and commanded the expedition against the Indians. He held many local civil offices, and in 1793 was elected U. S. senator.

FRELINGHUYSEN, FREDERICK THEODORE, b. N. J., 1817; nephew of Theodore; graduated at Rutgers college, and was admitted to the bar in 1839. In 1861, he was appointed attorney-general of the state, and was reappointed in 1866. In the latter year he was appointed to fill a vacancy in the U. S. senate. In 1870, he was regularly elected to the same office

FRELINGHUYSEN, THEODORE, LL.D., 1787–1862; b. N. J., son of Frederick; a graduate of Princeton, was admitted to the bar in 1808, and speedily became distinguished. In the war with England he raised and commanded a company of volunteers. In 1817, he was chosen attorney-general of the state; and in 1829 U. S. senator, acting with the whig party. In 1838, he was made chancellor of the university of New York. In 1844, he was the whig candidate for the vice-presidency. In 1850, he resigned from the university and removed to New Brunswick, where he died.

FREMONT, a co. in s. central Colorado. intersected by the Arkansas river. and the Denver and Rio Grande railroad; about 1800 sq.m.; pop. '70, 1064. The surface is mountainous, but the valleys are fertile. Copper, silver, coal, and lignite are found. Co. seat, Cañon City.

FREMONT, a co. in s.w. Iowa, on the Missouri river, intersected by the Kansas City, St. Joseph and Council Bluffs, and a branch of the Burlington railroads; 500 sq.m.; pop. '70, 13,719. The surface is diversified with prairies and forests, and the soil is fertile, producing corn, wheat, oats, etc. Co. seat, Sidney.

FREMONT, a city and seat of justice of Sandusky co., Ohio, on the Sandusky river and the Lake Shore, and the Lake Erie and Louisville railroads, 30 m. s.e. of Toledo; pop. '70, 5,455. The city is at the head of steam navigation on the river. It has several important schools, and a number of manufactories, foundries, etc.

FREMONT, JOHN CHARLES, an eminent American traveler and explorer, son of a French emigrant gentleman and a Virginian lady, was b. at Savannah, Ga., Jan. 21, 1813. He lost his father at the age of four years, and removed to Charleston with his

mother, where, at the age of 15, he entered Charleston college. For two years, he taught mathematics on board the sloop-of-war *Natchez*, received his degree in 1835, and soon after passed a rigorous examination for the post of professor of mathematics in the navy, and was appointed to the frigate *Independence;* but resolving to quit the sea, he turned his attention to civil-engineering, and was employed in the Mississippi survey, and similar undertakings. In 1840, he received from president Van Buren a commission as second-lieut. in the corps of topographical engineers, and was ordered to make an examination of the river Des Moines, upon the western frontier. In 1841, he married the daughter of col. Benton. He now proposed to penetrate the Rocky mountains, and, his plans being approved of, he reached and explored the South pass in 1842, with only a handful of men. He thus demonstrated the feasibility of an overland communication between the two sides of the continent, and discovered the route to California, since followed by thousands. During the whole of his journey, he made careful barometrical and astronomical observations, and noted attentively the geography, botany, and geology of the district. A lofty peak which he ascended, 13,750 ft. above the sea, is now called Fremont's peak. His report of the expedition was laid before congress in the winter of 1842–43, and attracted great attention both at home and abroad.

He immediately planned a second expedition more extensive than the first, and determined to survey the then unknown regions lying between the Rocky mountains and the Pacific ocean. He commenced his journey in May, 1843, explored the Kansas river, crossed the South pass, and, after 1700 miles of traveling, came, on Sept. 6, in sight of the Great Salt Lake, of which very vague and erroneous notions were entertained. He advanced as far as fort Vancouver, 90 m. from the mouth of the Columbia river, and then commenced his return. He selected a route leading to the upper Colorado, through an almost unknown region, crossed by rugged mountain-ridges. He soon encountered deep snows, and found himself in a bare and desolate country, with the prospect before him of death from cold and hunger to his whole party. After suffering the greatest hardships, he determined to make for San Francisco instead of the United States, and when he could get no Indian to guide him across the snow-covered mountains which lay between him and the valleys of California, he boldly undertook the passage without a guide. He accomplished it in 40 days, reaching Sutter's fort on the Sacramento, early in Mar., with his men almost reduced to skeletons, and only 33 out of 67 horses and mules remaining, and those so weak and thin that they could barely walk. He proceeded southward, along the western range of the Sierra Nevada, crossed that range through a gap, entered the great basin, and reached Washington in Aug., 1844. The remainder of the year was taken up in preparing his report. In consideration of his valuable services, F. was breveted capt. in Jan., 1845, and in the spring of the same year set out on a third expedition to explore the great basin and the maritime region of California. He took part in the war with Mexico, and cleared the northern part of California from Mexican troops. He then became involved in a dispute between two of his superior officers in regard to the right of command in California, which led to his trial by court-martial, and the unjust deprivation of his commission. The president offered to reinstate him, but as it was justice and not favor that he demanded, he resigned his position in the army.

In 1848, he started upon a fourth expedition, at his own expense, trying to find a practicable passage to California, along the upper waters of Rio Grande. In attempting to cross the great Sierra covered with snow, his guide lost his way, and F.'s party encountered horrible suffering, being even driven to cannibalism to support life, and losing one third of their numbers. In 1849, he settled in California, and in the same year was elected senator for that state. In 1850, baron Humboldt, on behalf of the king of Prussia, sent him "the great golden medal for progress in the sciences," while at the same time the geographical society of Berlin made him an honorary member. The royal geographical society of London also awarded him the "founder's medal for pre-eminent services in promoting the cause of geographical science." In 1853, he conducted a fifth expedition along the route of the fourth. In 1856, he stood for the presidency, and received 114 electoral votes from 11 states. In 1861, he was made a maj.gen., but gave up his command in 1862. In 1864, he was again nominated for the presidency, but withdrew in favor of Lincoln. He has since engaged in various railroad enterprises to the Pacific coast.

FREMONT, John Charles (*ante*), b. 1813; a distinguished American explorer and politician, at present (1880) governor of the territory of Arizona. In 1838, he was commissioned second lieutenant in the topographical engineers. In 1840, while in Washington making up reports of certain explorations in which he had been engaged, he met Jessie, the daughter of col. Thomas Hart Benton, U. S. senator from Missouri. She was only 15 years of age, and her father, hearing that she had engaged herself to Fremont, was so enraged that, by his influence, the lieutenant was sent upon a distant expedition to examine the Des Moines river. He completed his work within a year, and, returning, contracted a secret marriage. In 1842, a geographical survey of all the territories of the United States was proposed by him, and, although his idea was not entirely carried out, he was sent to explore the Rocky mountains, and directed to pay

particular attention to the South pass. In his accomplishment of this task, he ascended the mountain known as Fremont's peak—13,570 ft. above sea-level. His report of this expedition was much appreciated. His next enterprise was the exploration of the Rocky mountains towards the Pacific coast. Many persons still living remember when school geographies represented the vast region now covered by Nebraska, Kansas, Missouri, etc., as the "great American desert." Early in 1843, F. started with 39 men, and, after a journey of 1700 m., came to Great Salt lake, about which there had been no accurate information. Thence he proceeded northward to the tributaries of the Columbia river, following the valley to fort Vancouver. In November, he started upon his return, choosing a route through an almost unknown region, between the Columbia and Colorado. He and his men suffered terribly from the severe winter weather. In California, he found himself shut in by mountains, which, as he learned from the Indians, had never been crossed by a human being. In spite of this, he proceeded without a guide, and in less than seven weeks arrived at Sutter's fort, in California, the spot where, four years later, gold was to be discovered. Continuing his journey, on the 24th March he proceeded by the w. base of the Sierra Nevada, and crossing that range, revisited Great Salt lake, and by way of the South pass reached Kansas in July, 1844. Many months were passed in preparing his reports. In the spring of 1845, he started upon his third trip, intending to explore the great basin (now Utah), and the sea-coasts of California and Oregon. After examining the upper portions of the great rivers that run from the "divide" of the Rocky mountains towards the Mississippi and the Pacific, he made a further inspection of Great Salt lake. Thence he continued the exploration of the Sierra Nevada, again crossing that chain in midwinter. Leaving his escort at San Joaquin to recruit, he went on to Monterey, then the capital of California, to ask permission of the Mexican authorities to proceed. Permission was granted; but rumors of the war just commenced between Mexico and the United States alarmed the authorities, and the permission was revoked, and F. was ordered to leave the country at once. He refused, gathered his 64 men together, and established a fort on Hawk's peak, 30 m. from Monterey. Here he was besieged by a large Mexican force for four days, and forced to withdraw in the direction of San Joaquin. He had scarcely started when a message proposing a cessation of hostilities reached him, and F. was able to proceed without further annoyance through the Sacramento valley to Oregon. Near Klamath lake he fell in (May 9, 1849) with a party sent in search of him, with instructions from his government. He was enjoined to watch over the interests of his country in the event of Mexico entering into treaty with England for the transfer of California.

Castro, the Mexican governor in California, had threatened to destroy the American settlements along the Sacramento, and learning this, Fremont at once took stringent measures, and rescued the settlements. In less than a month he freed upper California from Mexican rule, and on the 4th of July was elected governor by the Americans. A week later, he learned that commodore Sloat, who commanded the U. S. squadron in the Pacific, had seized Monterey. On the 19th, Fremont joined him, with 160 mounted riflemen. At the same time, commodore Stockton arrived in the frigate *Congress*, with authority from the United States government to conquer California. At his desire, Fremont organized the mounted men known as the "California battalion," of which he was made major. Stockton also appointed F. civil governor of the territory, and Jan. 13, 1847, a capitulation was concluded which ended the war, and made California a possession of the United States. About this time gen. Kearney, with a force of dragoons, arrived, and a long quarrel ensued, owing to jealousy between him and Fremont, which resulted in the arrest of F., his trial by court-martial, and sentence to be dismissed from the service. The president remitted the penalty, but F. was so indignant that he at once resigned. Still intent upon overland exploration, in Oct., 1848, he started on his fourth trip across the continent, and at his own expense. With 33 companions, he sought to find a practicable route to California, passing along the upper waters of the Rio Grande del Norte, meeting several tribes of Indians who were at war with the United States. In crossing the Sierra Nevadas, then deeply covered with snow, he and his men endured the most terrible sufferings, some of them being driven to cannibalism. More than a third of the men and all the animals perished, and those who remained were compelled to return to New Mexico. Still persistent, Fremont collected another party of 30 men, and in the spring of 1849, after prolonged effort, found his way over the various mountain ranges to the Sacramento. Satisfied at last, Fremont settled in California, and was sent by the legislature as senator to represent the new state in congress. He now devoted his attention to the interests of California, although, having drawn the short term, he remained but a few months in office. In 1851, he failed of re-election to the senate, after 142 ballotings. In 1852, he made a tour in Europe, returned the next year, and organized another expedition across the continent to complete the surveys undertaken upon his fourth trip. On this occasion, he and his men endured great hardships, but they discovered passes through the mountains, and finally reached California in safety. In 1856, Fremont was the candidate of the newly formed republican party for president, but was defeated, having only 114 votes, against 174 for James Buchanan, the democratic candidate. In the war of the rebellion, he was appointed maj.gen., and obtained command of the western dis-

trict. On the last day of Aug., 1861, he ordered the emancipation of the slaves of those who, in his district, were in arms against the United States; but the president revoked it as unauthorized and premature. In this, F. anticipated by only 18 months the president's own proclamation, but in consequence of it he was relieved from command. A few months later, he was reinstated, and intrusted with the command of the mountain region of Virginia, Tennessee, and Kentucky. After the indecisive battle at Cross Keys, June 8, 1862, Fremont declined to serve, as gen. Pope was in command of the army of Virginia, and was an officer whom Fremont ranked. June 12, 1878, he was appointed governor of Arizona territory, and is still in office.

FRENCH, WILLIAM HENRY, b. Md., 1815; graduate of West Point; served in the Indian war in Florida in 1837, and in the Mexican war till the capture of the city of Mexico. In the war of the rebellion he was in command at Key West, and was made brig.gen., serving in the army of the Potomac; was created maj.gen. in 1862, and mustered out in 1864. He afterwards served in command of artillery on the Pacific coast.

FRENCH BEANS. See KIDNEY BEANS.

FRENCH BERRIES, Avignon berries, Persian berries, or yellow berries (Fr. *Graines d'Avignon*), small berries, the fruit of certain species of buckthorn (q.v.), but principally of the yellow-berried buckthorn (*rhamnus infectorius*), used by dyers in dyeing yellow, For this purpose, they are gathered unripe, and dried; they yield a rich yellow color, but it is fugitive, and on this account the use of this dye-stuff has very much given place to that of mineral dyes. It is, however, still imported into Britain from the Levant and from the s. of France. That from the Levant is the best The yellow-berried buckthorn is a very spreading procumbent shrub, with ovato-lanceolate smooth leaves, growing naturally in rough, rocky places in the countries near the Mediterranean. It is cultivated to some extent in the s. of France.

FRENCH BROAD RIVER, rising in North Carolina, passing into Tennessee, emptying into the Holston, 3 m. above Knoxville. It is over 200 m. long, is in some parts navigable by steamboats, and runs through the remarkably fine scenery of the Painted Rocks and the Chimneys.

FRENCH HONEYSUCKLE, *Hedysarum coronarium*, a beautiful biennial plant of the natural order *leguminosæ*, sub-order *papilionaceæ*, with branching and spreading stems, pinnate leaves, scarlet or sometimes white flowers, and jointed pods, which have one seed in each articulation. It has fine foliage, and a very elegant appearance, and is often to be seen in flower-gardens. It is a native of the s. of Europe, and is there pretty extensively cultivated as food for cattle. It grows to a height of 4 or 5 ft., yields a large crop, and is very nutritious. It is used either in a green state, or dried as hay. It requires a rather warmer climate than that of England for its profitable cultivation. The genus *hedysarum* contains many species, extensively diffused over the warmer parts of the world. A few are found in cold regions, as *H. fruticosum* in Siberia, growing in sandy soils, very useful in fixing them by its roots, and valuable as affording food for horses.

FRENCH LANGUAGE AND LITERATURE. The *French language* has been developed under the combined influence of numerous forms of speech, among which Latin, as in every other tongue of western Europe, takes a principal part. It would appear that in the 4th and 5th centuries of our era, the whole of Gallia, from the Rhine to the Pyrenees, had adopted the language of the Roman conquerors, not the polished speech of the classic writers—the *sermo urbanus*—but the form of Latin that had become common to all the subjugated provinces of central Europe—*lingua Romana rustica*. Suetonius, Pliny, Juvenal, and Martial make frequent reference to the Latin in use in southern Gaul and Spain; and in the 4th c. we find that, under the emperor Theodosius, the Roman senate was addressed by an orator of Gaul in rude and uncultured transalpine Latin. At this period, and much later, Latin was employed in the provincial assemblies of Gaul; but in the 7th c., two other forms of speech had come into general use—a provincial dialect of the *lingua Romana*, and a form of German known as the *lingua Theotisca*. The latter, which was probably a mingled jargon, used in common by the Frankish and Teutonic tribes, and consequently in vogue in the north and east, received a more definite development under Charlemagne, who caused a grammar of it to be prepared for the use of the schools which he had established, and in which it was taught conjointly with Latin. The council of Tours (813) recommended the use both of the rustic Latin and the Teutonic dialect; and in 842, in the compact made between the two brothers, Charles the bald and Louis the German, the former swore in the *Romana rustica*, and the latter in the *Teutsche* language, which, although it had been generally spoken at the court of Charlemagne, had already given place in France to the Frankish form of Latin. This Gallo-Romanic idiom early branched off into the two characteristically different forms of the *Provençal* or *Langue d'oc* of the south, and the *Roman Wallon*, or *Langue d'oïl* of the north. The comparative prosperity which the s. of France enjoyed, first under the kings of Arles, and subsequently under the counts of Provence, its freedom from foreign aggression for several centuries, the beauty of the climate, and the more thoroughly Romanized character of the people, led to the early development of the Provençal, and, by the lips

of the troubadours, breathed forth a rich melody of song, which, after a time, was re-echoed in less harmonious tones by the *trouvères* of the north in their ruder tongue. The earlier productions of these two schools exhibit striking differences in diction, inflection, and construction; and while the troubadour sang of love, and dwelt on the beauties which a southern climate and a fruitful soil scattered broadcast over the face of nature around him, the northern *trouvère* invented a chivalrous mythology of his own, and ascribed to the heroes of Greece and Rome, and the brethren in arms of king Arthur and Charlemagne, the sentiments of his own times. The use of the northern or Walloon French was very considerably extended through its adoption by the Normans, who in time carried it under William the conqueror to England, and, under the northern leaders of the crusades, to the south and east. In the south, on the contrary, the cruel persecutions of the Albigenses, against which the troubadours inveighed aloud, checked the development of the Provençal language; for the songs of the troubadours were proscribed, and thus the use of the *langue d'oïl* soon extended with the spread of northern power into the provinces of Provence and Languedoc. One of the earliest monuments of the French-Walloon, in the form in which it shows evidence of its gradual development into modern French, is the *Roman de Rou*, a versified chronicle of the exploits of Rollo and his successors, composed by Robert Wace. In this composition, the language is no longer the sonorous, many-voweled Provençal, or the mongrel Latin of the *lingua rustica*, but a distinct form of speech. The language thus formed by the ingrafting of Norman, Frankish, and Teutonic idioms on the degenerate Latin of the Gallic provinces, was rapidly developed under the fostering influence of the university of Paris and the Sorbonne, which already, in the 13th c., attracted the learned men of all nations to their schools. The *Roman de la Rose*, begun in the 13th c. by Jean de Meung, and completed in the 14th c. by G. de Lorris, and *Guyot's Bible*, belonging to the same period, are typical of the literature of France in the middle ages, which consisted chiefly of tales of chivalry and coarse sallies against the clergy. Froissart's chronicles of the 14th c., which afford a vivid picture of the wars of the English and French, in which he himself took an active share, are written in a dialect that is quite comprehensible to the modern student. Comines, who wrote in the 15th c., is a less picturesque narrator; but he may be classed among the earliest true historians of his country, for he was one of the first who observed public events with judgment, and recorded what he had seen in a straightforward, truthful manner. Francis I., by his love of music, song, and dramatic representations, gave indirect encouragement to literature; while the French language acquired force and terseness through the writings of Rabelais, Ronsard, Amyot, and Montaigne, and although, under the regencies of Catharine and Marie de' Medici, Italian writers were more patronized at court than native authors, the language and the literary talent of the nation were undergoing a process of gradual development, which was completed by the establishment, under the auspices of Richelieu, of the *Académie Française* in 1634. At this period, Corneille brought French tragedy to its highest point of grandeur in the classic style of the drama, which he had adopted. His best pieces are *Le Cid*, *Les Horaces*, *Cinna*, etc. Pascal, in his *Lettres Provinciales*, established a standard of French prose; while Descartes, in his *Discours sur la Méthode*, showed the adaptability of the language to subjects requiring conciseness and precision. A long galaxy of great names gave splendor to the reign of Louis XIV. in every branch of literature. Notwithstanding the frivolity of the habits of the higher classes in France during this period, no age produced more vigorous writers or original thinkers. Bossuet and Flechier won respect by their noble funeral orations; Bourdaloue and Massillon, by their eloquent preaching; Fénélon, by his learning and earnest exhortations; and Pascal, by his Christian view of the great questions of human experiences. In dramatic literature, Racine and Molière stand forth conspicuous among a host of lesser writers, the former pre-eminent in tragedy, as his *Andromaque*, *Iphigénie*, *Phèdre*, testify; the latter inimitable in comedy, and exhibiting wonderful powers of delineating human character from a humorous point of view, that have never been surpassed. Among his best pieces we may instance *Tartufe*, *Le Misanthrope*, and *Les Femmes Savantes*. La Fontaine is alike well known among his countrymen for his moral Fables and his licentious Tales. La Rochefoucauld and La Bruyère, in their *Sentences* and *Caractères*, depicted human character, with its peculiarities, inclinations, and foibles, in strong, humorous, and vivid touches. This was the age of memoirs and letters: in the former branch of contemporary history, cardinal Retz was perhaps the most successful of the host of writers who gained a reputation in this special department of literature; while Madame de Sévigné's letters are models of easy epistolary style, and afford a lively picture of the times. This age, in which, at any rate, the *semblance* of religion had been respected, was followed by one of scepticism, infidelity, and philosophical speculations of the wildest kind. Four men of genius, Montesquieu, Voltaire, Rousseau, and Buffon, contributed, to a very great extent, by their writings, and the influence which they exerted on the minds of their contemporaries, in bringing about the revolution. Montesquieu, by his philosophical dissertations on the laws and government of his country, taught the French to take more enlightened views of the rights and duties of different classes of society, and thus naturally roused the angry passions of the oppressed lower orders; while the passionate eloquence of Rousseau won a hearing for doctrines which were entirely subversive of moral obligations, and recognized no higher standard than

human inclinations. Voltaire's versatility of powers, which were exercised with equal ease, and nearly equal success, on tragedy, satire, romance, poetry, history, and philosophy, enabled him, to the end of his long life, to maintain the supremacy over public opinion, which he had won in his youth. Buffon devoted himself to the study and description of nature, and his *Histoire Naturelle*, which inaugurated a new era in the literature of natural history, is a remarkable monument of the science and learning of that period. Diderot, and D'Alembert the geometer, founded the *Encyclopédie*, which, while it gave a lucid summary of numerous branches of human knowledge, was always hostile to religion. The revolution, which had been materially accelerated, if not produced, by the inspirations of men of consummate intellect, was not favorable to literature. A period of almost complete intellectual torpor succeeded the active mental development that had characterized the preceding classic and philosophic periods. The empire was scarcely more propitious to learning; but with the *Corinne* and *L'Allemagne* of Madame de Staël, and *Les Martyrs* of Chateaubriand, a reaction took place; and these productions of the new romantic school were soon followed by numerous others, either belonging to the same, or to the rival classical school. Among the host of young and original writers who now acquired reputation, we may instance, in poetry, dramatic art, and fiction, Victor Hugo, the greatest of living French poets, Alfred de Vigny, Fréderic Soulie, and A. Dumas the elder, one of the most prolific of novel-writers, among whose most popular works are—*Les Trois Mousquetaires; Le Comte de Monte Christo; Le Collier de la Reine;* etc. He published ample reminiscences of his various travels and personal adventures in *Le Caucase; Voyage; Les Mémoires d'Horace; Mémoires de Garibaldi;* the successive volumes of his own *Memoires;* etc. The catalogue of his writings is scarcely conceivable for its extent, numbering, it is said, above 1200 volumes. Casimir Délavigne has attempted to combine the romantic and classical schools in his *Louis XI.; Les Enfants d'Edouard,* etc. George Sand (Madame Dudevant) is one of the most elegant writers of her country, and her works are models of style. Her *Indiana*, which appeared in 1832, inaugurated a new era of emotional novel-writing, and has had numerous imitators. Among her numerous works, the most popular are *Lélia; Mauprat; André; Consuelo,* and the numerous pieces which she subsequently wrote for the stage, such as *François le Champi; Marquis de Villemer;* etc. *Les Mystères de Paris*, and *Le Juif Errant*, which depict the concealed miseries and depravities of social life, quickly brought their author, Eugène Sue, into notice. The tendency to materialism and sensualism, which characterizes the works of the two last-named writers, is more or less perceptible in all belonging to their age in France. The few artistic and good historical novels that have appeared have not met with the success they deserved. Among other recent writers of fiction, we may especially instance Balzac; A. de Musset, with his unrivaled richness of fancy, and melody of speech; Jules Sandeau, with whom Madame Dudevant wrote in conjunction; the historian Merimée; Théophile Gautier; Paul de Kock; the literary partners, Erckmann-Chatrian; Edmond About; and Dumas the younger, who has latterly devoted himself mainly to writing for the theater, which still absorbs much of the talent of France (as in Sardou's case). Till recently, few names in the domain of poetry, beyond those of Béranger, Lamartine, Victor Hugo, De Vigny, Sainte Beuve, and De Musset, were much known out of France; Gautier and De Banville, lyrists of the romantic school, have of late obtained a favorable hearing in many lands; and De Lisle is recognized as the head of a small but popular modern school. History is undoubtedly the most successful branch of modern French literature. Among those who have gained for themselves a world-wide reputation in this department of research, we would instance Barante, whose early work, *L'Histoire des Ducs de Bourgogne*, has been followed by his able histories of the *Convention* and *Directory*. Guizot has shown indefatigable powers of research and a philosophic power of generalization in a great number of works, among which the first rank may be awarded to his *Essais sur l'Histoire de France*, and *L'Histoire de la Civilisation en Europe*. Thierry, in his *Lettres sur l'Histoire de France*, and *L'Histoire de la Conquête de l'Angleterre par les Normans*, displays great powers of narration and aptitude for theoretic criticism, perhaps more imaginative than sagacious. Sismondi has shown great research and profound knowledge in his somewhat diffuse history. The late president A. Thiers has devoted his learning, industry, and powers of delineation to the exposition of the revolutionary and imperial phases of French government. Louis Blanc, in his *Histoire de Dix Ans*, gives one of the most vivid pictures of contemporary history that we possess. Lamartine, who carries his poetic inspirations and enthusiastic temperament with him into his historical researches, presents magnificent but not perfectly trustworthy pictures of history in his *Histoire des Girondins; Histoire des Constituents;* and *Histoire de la Restauration*. Villemain, although better known for his history of literature, is yet to be classed among historians. Michelet is known as the brilliant author of the *Histoire de France*. Martin and Taine, both recently admitted members of the académie, may close the list.

There is no department of the moral and physical sciences that has not been enriched and elucidated by the labors of French savans. Among the great scientific writers of modern France, we may instance in metaphysics and political economy, Victor Cousin, Jouffroy, Simon, and Lamennais, whose eloquent defense of spiritualistic and religious principles reacted strongly against the materialism to which French philosophy

had long been addicted; while socialism has found powerful advocates in Comte, St. Simon, Fourrier, and Leroux. Chevalier, le Tocqueville, Bonald, and Laferrière, are known for their able and philosophic exposition of the jurisprudence of nations, and the social and political condition of democracy in the new and old world. In philology and ancient history, Champollion, Sylvestre de Sacy, Renan, Remusat, and Stanislas Julien, by their profound researches into Egyptian hieroglyphics and Semitic literature, have thrown new light on the origin of races and languages. In mathematics, D'Alembert, Laplace, Lagrange, Biot, Ampère, and Arago stand unrivaled. In natural history, and its kindred sciences, among a host of great French discoverers, we can only instance a few of the more distinguished, as Cuvier, Geoffroy and Isidore St. Hilaire, Blainville, Jussieu, D'Orbigny, Haüy, Gay-Lussac, Elie de Beaumont, Milne-Edwards, and Brongniart, whose painstaking and important services in the cause of science have identified their names with the triumphs of physical research.

No country has ever produced a greater number of elegant essayists and literary critics than France, and no language seems to lend itself more readily than French to a concise and graceful, yet forcible style of epigrammatic writing, and few admit of more idiomatic terseness, or a more polished play of words.

For authorities on French literature, see Nisard, *Hist. de la Littér. Française* (1846); Villemain, *Tableau de la Littér. au Moyen Age* (1857); Demogeot, *Hist. de la Littér. Franç.* (1857); Littré's *Histoire de la Langue Française* (1867); Gidel's *Histoire de la Littérature Française* (1875); *La Littérature Française*, Staaff (1869 to 1873); *History of French Literature*, by H. Van Laun (1877 to 1879).

FRENCHMAN'S BAY, an ocean inlet in Hancock co., Me., running inland about 30 m., with a width in some places of 10 miles. Near the w. side of the entrance is Mt. Desert island. There are good harbors, and the sound is free from ice in winter.

FRENCH POLISHING, the name given to the now common method of coating wood with a fine smooth surface or varnish of gum-lac. Gum-lac is easily soluble in spirits of wine, methylated spirits, or wood-naphtha, and a varnish is thus produced; but if it be applied simply with a brush, as copal, mastic, and most other varnishes are applied, the result is a very rough and broken surface, instead of a smooth continuous polish. To obtain this with a lac-varnish on wood, it is necessary to apply a very small quantity at once, and to rub it continuously until it dries. If a dry rubber be used, the lac sticks to it, and it is dragged from the wood. An oiled rubber is therefore used, and the oil should be a drying oil, such as linseed. Various kinds of rubbers are used; such as a ball of wool covered with rag, a small rol' of cloth with the edges downwards, and likewise covered with rag. The varnish and oil may be mixed together in a bottle, shaken up when used, and a little poured upon the rubber; or a simple solution of shellac may be used, and some of this laid upon an oiled rubber. Several successive coats and rubbings are required, and some skill is necessary, in order to produce a good surface.

The following are some receipts for French polish for mahogany; they might be multiplied to a great extent, for they should be modified according to the kind of wood to which they are applied, and the mode of applying them: 1. 5 oz. of pale shellac, dissolved in 1 pint of wood-naphtha, or methylated spirit, or spirits of wine. 2. 5 oz. of pale shellac, 1 oz. gum sandarac, 1 pint spirit. 3. 1½ lbs. pale shellac, ½ lb. mastic, 2 quarts spirit. 4. Shellac, 6 oz.; spirit or naphtha, 1 pint; linseed oil, ½ pint. The last is the most easy to apply; it requires no oil on the rubber, and is a very good domestic polish for restoring furniture, if properly applied by careful and continuous rubbing.

FRENCH PROPHETS, one of the strange sects or orders which arose during the great religious revolution in the time of the Camisards. They were Protestants, but imagined themselves endowed with inspiration. They held that they were immediately influenced by the Holy Spirit; trances very commonly occurred among them, and the populace looked upon their body with a certain amount of superstitious awe. England and Scotland were visited by some of their number. In both countries they succeeded in obtaining converts. They awaited the speedy coming of the Messiah to establish his kingdom, and laid claim to the gift of tongues. They also asserted their ability to work miracles, but having upon one occasion insisted upon their power to raise a dead man to life, the failure of their pretension brought about the dispersion of the sect.

FRENCH PROTESTANT CHURCH. See HUGUENOTS.

FRENCH RIVER, a stream of Upper Canada, empties lake Nipissing into lake Huron, entering Georgian bay, in lat. 45° 58′ n., and long. 81° 5′ west. It has a rapid course of about 60 m.; and, toward its mouth, is so uniform in breadth and depth, as to resemble an artificial cut through bare rock. It forms part of the route by which canoes, preferring the Ottawa to the St. Lawrence, pass from Montreal to the Red river of the north.

FRENCH SETTLEMENTS. See PONDICHERRY.

FRENCH WAR IN NORTH AMERICA is the name usually given to the struggle between the French and English (1752 to 1760) for the possession of the North American continent. It is also known as the old French war. The French, being in possession of Canada and Louisiana, intrenched their forces on the banks of the St. Law-

rence and near the mouth of the Mississippi, and attempted, by the occupation of various points in the interior, with a line of military posts, to confine the English colonies to a narrow strip of territory on the Atlantic coast. In this project the Indians of the west became the allies of the French. The territory watered by the Ohio was claimed by both France and England, but had been settled by neither. A small settlement of Virginians was established on the Monongahela, and settlements in Ohio were in contemplation. The governor of Virginia organized a force to take possession of the spot now occupied by the city of Pittsburg. But the French obtained possession of the place, which they named fort Duquesne, and held until 1758. In the struggle of the English to dispossess the French at this place, Washington took a prominent part, and it was here that Braddock was defeated in 1755. Ticonderoga, Crown Point, and Niagara were taken by the English in 1759, and the war in America terminated in the capture of Quebec, by gen. Wolfe, but the struggle for possession of Canada continued in Europe until, on Sept. 8, 1760, it was ceded to England. France retained possession of Louisiana until 1762, when she ceded it to Spain, thus yielding her last foothold upon the North American continent.

FRENCH WINES (FRANCE, *ante*). The vineyards cover 4.27 per cent of the surface of France, and are one of the chief sources of its agricultural wealth. They are to be found, more or less, in every district, except in ten northern departments. In 1862, according to statistical documents then published by the government, the departments in which the vine was most extensively cultivated were Hérault (162,172 hectares), Charente-Inférieure (157,753), Gironde (126,220), Charente (100,008), Gers (94,790), Gard (94,200), Dordogne (87,252), Aude (81,869), Var (79,040), Lot-et-Garonne (69,166). The vintage of 1876 gave a total of about 41,846,748 hectoliters (921,033,017 gallons). In everything relating to this culture the French are unsurpassed. The various first-class wines which they produce, under the names of Champagne, Burgundy, Bordeaux, etc., are in general demand in every part of the world. The vineyards produce annually about 7,706,961 pipes of wines (a pipe being usually estimated at 105 gallons), valued at $52,084,018, and 228,129 pipes of brandy, valued at $11,433,852, giving an aggregate value of $63,517,870. In the department of the Gironde there are now about 140,000 hectares of vineyards, producing annually on an average 2,280,000 hectoliters of wine. These wines are celebrated for their variety, their excellence, the low price of their common qualities, and the enormous price of their first qualities. The production amounts to an annual clear value of 180,000,000 francs. The Gironde is practically divided into five wine-producing districts, namely, the Médoc, a district on the left bank of the Garonne, extending from Blanquefort to the sea; the Graves, or high plains above the confluence of the Garonne and Dordogne; the Côtes, or inclined banks of the right side of the Garonne; the Palus, or low marshy territory on both banks of the Garonne in the more immediate neighborhood of Bordeaux; and the district of Entre-Deux-Mers, or low land between the Dordogne and Garonne. The Médoc district produces the wines of Labarde and Cantenac; in its very heart those of Margaux; and northwestward the Saint Julien and Pauillac. Still further north it produces the St. Estèphe, and at its northwestern limits the wines of Saint Seurin-de-Cadourne. The variation of the soil causes a great variety in its products, so that the best and the inferior wines grow frequently side by side. As the vines are the same, and their cultivation identical, the soil must usually account for the difference; but the special conditions of this difference are as yet unknown. The Graves district occupies the heights in the immediate neighborhood of Bordeaux. The vine succeeds very well, and the wines obtained are of greater body, deeper color, and more spirituous than those of the Médoc. The bouquet is not great, and they require six or eight years in barrel before they can be put into bottles. After that time, however, they remain excellent. The first quality of the red wines is that of Château Haut-Biron, classed immediately after those of the Châteaux Margaux, Lafitte, and Latour. The product is from a surface of forty-four hectares, and the principal vines cultivated here are Gross Viduro, and the Vidure Sauvignonne, together with the Malbec and the Cruchinet. The white wines of the Graves, or Sauternes district, are produced on the left bank of the Loire, in the neighborhood of Langon. The principal vines planted are the Sémillon and the Sauvignonne, mixed here and there with a little Muscatel. The principal growths of the district are the Barsacs, Sauternes, and Bommes. Those wines of the Gironde which are called wines of the hillsides, or "Vin de Côtes," are obtained on a chain of hills which extend along the right bank of the Garonne from Ambarez to Saint-Croix-du-Mont. The most celebrated are those grown in the vineyards of Saint Émilion, which occupy 1041 hectares. The varieties of grapes in this district are the Noir de Prussac, the Murlot, and the Bouchet, or Cabernet. Red and white wines are produced in the districts of Libournais, Fronsadais, and Blayais, and large quantities are exported under various names to America.

Roussillon is the name of an ancient province of France now merged in the department of the Oriental Pyrénées. There are here more than 50,000 hectares of vineyards in which three kinds of wine are produced—liqueur wines, dry wines, and wines largely used for the manufacture of factitious port and other wines. The most celebrated vineyards of the district are those of Banyuls-sur-Mer, Collioure, Port-Vendres, Rive-

saltes, and Perpignan. The prevailing wines are the Grenache noir and the Carignan. Large quantities of the Banyuls, Collioure, and Port-Vendres wines are sent to the United States to be there manufactured into liqueur wines, and to the Brazils to be drunk as dry wines. The vineyard of Rivesaltes is the most important on account of its size, having 10,500 hectares. It makes what is called specialties which have a limited reputation. Such are the Muscat, the Maccabéo, the Malvoisie, the Grenache, and the Rancio.

Languedoc, like Roussillon, is the name of an ancient province in France, and comprises the essential parts of the departments of the Aude, of the Hérault, and a portion of the Gard. The wines in this part are rich in color, and distinguished by much body and spirituosity; they are the objects of a vast and increasing commerce, as no country can compete with the united advantages of climate, soil, and situation, by means of which great quantities of cheap and salable wines ars produced. The surface occupied by vineyards in the three departments mentioned, comprises 258,192 hectares. The wines are divided into two categories, wines for the distillery, and wines of commerce, and are known generally under the name of *vins du midi.* The vines cultivated are the Carignan, the Terret-noir, the Grenache, the Monrastel, the Aspiran, the Œillade, and its variety the Sinsaou, the black Picpoule, the white Picpoule, and the Clairette. For the distillery wines only two vines are cultivated, namely the Aramon and the Terret-bourret; they cover the whole of the plains of Hérault and of St. Guilhem upon the sea, the plain of Lunel, of Orbe, and a part of that of Aude. The remarkable growths in the department of the Gard are the Lédenon, Langlade, and St. Gilles; in the department of Hérault, the St. Georges D'Orques, St. Chrystol, and St. Drézéry (red wines), the Picardans (white wines), the Frontignans and Lunels (muscat wines). The best wines of the Rhône valley are produced on the right bank of the Rhône, in the communes of Laudun, Chusclan, Tavel, Roquemaure, which belong to the department of the Gard; in the St. Péray district, department of the Ardèche, and at Condrieu and Côte-rôtie, department of the Rhône. A much smaller quantity of wine is grown on the left bank of the Rhône, but this includes the products of Château-neuf-du-Pape, department Vaucluse, and of L'Ermitage, department of the Drôme. The vineyards of Croyes, Larnage, and Mercurol, in the same department, produce wine which in quality follows immediately after Ermitage. Of these wines those grown in the Gard have the general character of the wines of the Midi; the black grapes grown in this district are the Terret, Picpoule, Piran, Camanèze, Grenache, or Alicante, and in some localities the Uni and the Bourboulenque are grown on a small scale with the others. Of the white grapes the Clarette and Calitor form about a fifth part; the others are Uni blanc, Picardan, and several unimportant varieties. The wines of Château-neuf-du-Pape owe their trade value and export to Burgundy to their spirituosity and color. The most remarkable are the vineyards of La Nerthe, Fortia, Vandieu, and the Cru de Condorcet. The most celebrated growths of St. Péray are Côteau-Gaillard, Solignacs, Thioulet, and Hongrie; after these range Savoie-les-Sapettes and Malayon. The dominant vine is the Grosse Roussette. The white St. Péray has a character of its own, particularly in the effervescent state. The vineyards of the Ermitage are of three kinds, according to the soil, granitic, constituting the so-called "Mas des Bessas," alluvial, forming the "Mas du Méal," and alluvial clayey, forming the "Mas de Greffieux." The high quality of the Ermitage wines depends upon the combination of these three vineyards, the produce of which is always sold mixed. Red Ermitage is used largely for adulterating Bordeaux wines. When genuine it is distinguished by great richness, a lively purple color and a special bouquet; it becomes by these united qualities the best wine of the south of France.

The vineyards of Crozes, Larnage, and Mercurol take rank next to that of Ermitage. The wine of the vineyards of Larolière and Die is a sweet, syrupy drink. Under the name of white wines of Condrieu are comprised the wines grown in that locality and also those of St. Michel in the department of the Loire. The wine of these districts is a kind of imperfect champagne. The vineyard of Côte-Rôtie is situated in the commune of Ampuis, and is divided into five parts by the two principal growths, Côte-Brune, where the Terine noire is more prevalent, and the Côte-Blonde, which has more Vionniers. The wine is fiery and heady, but has great fineness and bouquet.

The districts of the Beaujolais, Mâconnais, and the Chalon Côte are situated in the higher parts of the valleys of the tributaries of the Rhône, particularly the Saône. The high Beaujolais consists of the cantons of Beaujeu and Belleville, where the best vineyards are met with. The low Beaujolais produces a greater quantity of wine, but of a less distinguished quality. The prevailing vines are the Petit Gamay and the Gamay Nicolas. The Mâconnais district includes the vineyards of Thorins and the Romanèche, which produce the finest class of wine, the vineyard of St. Amour, Davayé, Pouilly, the whole district n. of Mâcon, and the canton of Lugny. Formerly the Pineau known under the name of Bourguinon was the exclusive vine of the distinguished growths; but this has almost entirely disappeared, and given place to the Gamay. The wine of Mâcon of cheap quality is mostly sold in Paris, Lyons, and Geneva. The better Mâcon wine is sometimes carried into the Bourgogne to be sold as wine of that country. The best wines of the Côte of Chalon are obtained on the incline which commences n. of Chalon, runs through Jivry, and then loses itself in the Mâconnais. Ordinarily only

common wines are produced in the Côte of Chalon district. The better qualities have much likeness to the half fine wines and great ordinaires of the Côte d'Or, but they are less marrowy and have a less free taste. Burgundy is probably the oldest wine-growing country in central Europe, and that part which produces the best wines of this department has been called by the French Côte d'Or or "golden-hill-side." This is formed by a series of hills about thirty-six miles in length, which stretch from Chalon on the the Saône to Dijon, in the direction of n.n.e. to s.s.w., their cultivated inclination and exposure being consequently towards the east. The black grape peculiar to the Bourgogne, the Pineau or Noirien, is the dominating vine along the Côte. Another variety which frequently occurs in Burgundy is a light red one called Beurot, known in Germany as Rulånder. Of white grapes there is the Chardenay, yielding among others the celebrated wine of Chablis. The best wines of Burgundy are distinguished by the suavity of their taste, their fineness, and spirituous aroma. The first growths of red wine are Romanée Conti, Chambertin, Richebourg, Clos Vougeot, Romanée de St. Vivant, Tâche, Clos St. Georges, and Corton, in the department of the Côte d'Or. The second class differ but little from those of the first, and generally take their place in commerce; this class includes the vineyards of Vosne, Nuits, Prémeau, Chambolle, Volnay, Pommard, Beaume, Morey, Savigny, Meursault, and others. Of the white wines the most celebrated are those of Montrachet, uniting body and strength with great fineness and bouquet.

The Champagne is an ancient province of France, situated under the 47th, 48th, and 49th degrees of latitude. At the division of France into departments it was cut up into four parts, which were respectively united with the departments of the Ardennes, the Marne, the Upper Marne, and the Aube. The wine to which this district owes its reputation is obtained not in all these departments, but only in that of the Marne, which includes the prefectures of Châlons-sur-Marne, Épernay, Rheims, Saint Ménéhould, and Vitry-sur-Marne. These districts contain 19,589 hectares of vineyards, which are situated on the territories of 453 communities and belong to 27,018 proprietors. An average vintage produces about 700,000 hectolitres. Of this, more than a quarter is drunk by the inhabitants themselves. Good wine, however, is produced only by the prefectures of Rheims and Épernay, and the manufactories of Champagne are obliged to draw their main supplies from them. The dominating vines in the Champagme are the black grape called plant doré, which is the same as the black Burgundy, and the meunier or miller. Another vine which occurs here and there is the marmot vert, identical with the elbing of the Moselle and the goix d'Orléans. The character of the effervescent champagne wines is derived mainly from the black Burgundy grape, with which in good years is mixed a certain quantity of the white Burgundy. The still champagnes are made—the red varieties from the black Burgundy only, and the white varieties from the white Burgundy only. Of the bottled wines which are produced in the Champagne, four varieties have to be distinguished. Champagne *non mousseux* is wine which has been fully fermented, fined, drawn into bottles, stopped in the usual manner of the mousseux wines, tied, and allowed to rest a long time. Champagne *crêmant* forms a slight cream of effervescent bubbles upon its surface when it is poured into a glass. Champagne *mousseux*, when opened, projects the cork with an audible report and begins to rise gently over the margin of the bottle. Champagne *grand mousseux* projects the cork with a loud report, and immediately overflows from the bottle.

The wines of the Champagne are light, fine, and delicate; they are very heady, but the exhilaration produced by them does not last long, and they are mostly wholesome. Of superior white wines are the dry Sillery grown at Ludes, Mailly, Verzenay, and Verzy; the soft wines of Ay, Mareuil, Dissy, Pierry, Hautvilliers, and the vineyard of Clozet, at Épernay; they are distinguished for their lightness, delicacy, and agreeable taste. Next to these range the red wines of Verzy, Verzenay, Mailly, St. Basle, Bourzy, and Clos de St. Thierry in the Marne department.

The wines of the valleys of the Loire and Charente extend from the neighborhood of Orléans through an enormous plain towards Blois, and thence towards Angoulême and Poictiers, and further towards the Charente, into the district of Cognac. The vines most common in that district are the meunier or miller, the teinturier or dyer, and the auvernat noir. The best cognac is made from white varieties of vines, namely, the Folle blanche, the Boillot, the Blanc doux, Colombar, Sauvignon, and St. Pierre. Sometimes red grapes are taken for distillation, but their spirit does not possess the soft and agreeable properties which are peculiar to that obtained from white grapes. The varieties cultivated for red wine are Balsac, Maroquin, and Dégoutant. The quantity of brandy produced in the Charente is about 180,000 hectolitres. France, although on the whole it produces few liqueur wines, yields a quantity of very good wines, which bear comparison with most of those of other countries. Of the finer quality are those of Roussillon, Dauphiné, and Languedoc. See BORDEAUX, BURGUNDY WINES, CHAMPAGNE WINE, and WINE, *ante*.

FRENEAU, PHILIP, 1752–1832; b. New York; graduated at the college of New Jersey, 1771. At the age of 17, he wrote *The Poetical History of the Prophet Jonah*, and on the outbreak of the revolutionary struggle aided the cause by many patriotic songs and verses. He went, during the war, to the West Indies in the service of a mercantile

house, and in 1780 was captured by the British, and confined in a prison ship at New York. His imprisonment did not abate the ardor of his patriotic verses. He subsequently made many mercantile voyages to the West Indies. He was one of the earliest American poets, and published several volumes of his pieces; and edited the *N. Y. Daily Advertiser*, the *National Gazette* of Philadelphia, the *Jersey Chronicle*, and the *Timepiece and Literary Companion*, issued in New York.

FRENTA'NI, a people in central Italy in the early ages, descended from the Samnites, but allies of Rome. They dwelt in a hilly region on the shores of the Adriatic sea.

FRÈRE, CHARLES THÉODORE, b. Paris, 1815; a painter, pupil of Coignet and Roqueplan; made his first exhibit in 1834. Two years later he went to Algeria, traversed the desert, visited the east, and was present at the fall of Constantine, Oct. 13, 1837. His favorite subjects for pictures were scenes from eastern life, but he occasionally produced military pieces. Small in size, his paintings are rich in color, accurate in design, and harmonious in execution. He twice received the medal—in 1848 and in 1865.

FRERE, Sir HENRY BARTLE EDWARD, nephew of John Hookham; b. England, 1815. In 1834, he entered the Indian civil service, and after holding some revenue appointments became, in 1842, secretary to sir George Arthur, then governor of Bombay. In 1856, he proceeded to Scinde, in the capacity of British president, and was made chief commissioner there in 1860. He was created a K.C.B. in 1859 in consideration of his service during the Indian mutiny, and the thanks of parliament were twice voted to him. In Mar., 1862, he was nominated governor of Bombay, whence he returned to England in 1867. He was created a knight grand cross of the order of the star of India, and was nominated a member of her majesty's Indian council at home. He long occupied the position of vice-president of the royal geographical society. In Oct., 1872, he was sent by the British government as special commissioner to e. Africa to inquire into the slave trade. Arriving at Zanzibar Mar. 12, 1873, he induced the sultan of Zanzibar to sign a treaty abolishing that traffic. Returning to England he was sworn a member of the privy council, and presented with the freedom of the city of London. Subsequently he visited India in the suite of the prince of Wales, and in Jan., 1877, was appointed governor of the cape of Good Hope, and high commissioner (for Great Britain) of s. Africa. During that year (1877) the Kaffer war occurred, and sir B. F. proceeded at once to British Caffraria, deposed the Galeka chief Kreli, and annexed his country to the queen's dominions in s. Africa. This conclusion was carried into effect by a considerable exhibition of British force, and the rising temporarily suppressed. But in 1878 it again broke out with renewed strength. Other powerful chiefs combined with those already in insurrection, and what promised to become a most serious outbreak was only finally quelled by the display of great firmness and energy on the part of sir B. F., who was but illy supported in his efforts by the British ministry, but who was still occupying his post at the beginning of 1880.

Sir Bartle Frere is president of the royal Asiatic society, and a vice-president of the royal geographical society, and of the society for the propagation of the gospel in foreign parts. A biographical memoir of his uncle, the right Hon. John Hookham Frere, prefixed to his "Works," was written by him, and among his writings may be mentioned *Christianity suited to all Forms of Civilization*, a lecture delivered in connection with the Christian evidence society; *Indian Missions*, reprinted from *The Church and the Age; Pandurang Hari, or Memoir of a Hindoo;* and *Eastern Africa as a Field for Missionary Labor*.

FRERE, JOHN HOOKHAM, 1796–1841. At Eton college, in 1785, he contracted an intimacy with Canning, which greatly influenced his after-life. From Eton he went to Cambridge, where he graduated in 1795. He commenced his public career in the foreign office under lord Grenville, and from 1796 to 1802 represented a Cornish borough in parliament. He warmly seconded Canning in the defense of Pitt's administration, and was an energetic contributor to the pages of the *Anti-Jacobin*. When Canning was appointed to the board of trade, he replaced him as under-secretary of state; in Oct., 1800, he was appointed envoy extraordinary and plenipotentiary to Lisbon; and, Sept., 1802, he was transferred to Spain, where he remained for two years. He was recalled on account of a personal disagreement, but his conduct was approved by the ministry, and in 1808, he was again sent out as plenipotentiary to Ferdinand VII. The condition of Spain rendered his position a very responsible and difficult one, yet had it not been for one unfortunate step he would have left the country with greatly increased reputation. When Napoleon began to advance on Madrid it became a matter of supreme importance to decide whether sir John Moore, who was then in the n. of Spain, should endeavor to anticipate the occupation of the capital or merely make good his retreat; and if he did retreat, whether he should do so by Portugal or by Galicia. Frere was strongly of the opinion that the bolder was the better course, and he persistently urged his views on sir John Moore. After the disastrous retreat to Corunna, the public accused Frere of having by his advice endangered the British army, and, though no direct censure was passed upon his conduct by the government, he was called home, and the marquis of Wellesley was appointed in his place. Thus ended Frere's public life.

He afterwards refused to undertake an embassy to St. Petersburg, and twice declined the honor of a peerage. In 1816, he married Elizabeth Jemima, dowager countess of Erroll; and in 1820, on account of her failing health, he went with her to the Mediterranean. In quiet retirement he devoted himself to various literary labors, studied Greek authors, and taught himself Hebrew and Maltese. His hospitality was well known to many an English guest, and his charities and courtesies endeared him to his Maltese neighbors.

FRERE, Pierre Edouard, b. France, 1819; a painter who worked in the studio of Paul Delaroche, and in 1843 exhibited his first picture in the salon. He received two third-class medals—in 1850 and 1855—and a second-class medal in 1852. At the close of the exposition of 1855, he was decorated with the cross of the legion of honor. He excelled in genre painting, and lithography has made his works popular and familiar to every one. Some of his paintings have found their way to America.

FRÉRON, Elie Catherine, a French writer, was b. at Quimper in 1719, educated under the Jesuits at the college of Louis le Grand, and first acquired a reputation by his publication of a critical journal in 1746. This journal appeared under the curious title, *Lettres de Madame la Comtesse de* * * *. It was suppressed in 1749, but virtually re-appeared as *Lettres sur quelques Écrits de ce Temps* (13 vols., 1749–54), and was again continued under the title of *Année Littéraire* (1754–76). F. exhibited the most intense bitterness against his leading contemporaries. A worshiper of the age of Louis XIV., he hated and satirized the leveling philosophy of his times. Voltaire was the special object of his aversion, and that sensitive scoffer was deeply galled by the weekly diatribes of his antagonist. The names of Voltaire and F. are inseparably, though not amicably, conjoined in the history of literature. F. was often right in his criticisms and in the accusations which he brought against his adversaries, but opinion in France in the 18th c. was swayed by epigrams, and F. fell a victim to the animosity of the wits. He died of grief, Mar. 10, 1776.—Louis Stanislas Fréron, a son of the former, was born in Paris in 1765, played a somewhat prominent part in the melodrama of the French revolution, and in 1802, was sent as sub-prefect to the island of St. Domingo, by the first consul, but died two months after his arrival.

FRERON, Louis Stanislas, 1765–1802; a French revolutionist. His name was, on the death of his father, attached to *L'Année Littéraire*, which was continued until 1790, and edited successively by the abbes Royou and Geoffroy. On the outbreak of the revolution, Freron, who was a school-fellow of Robespierre and Camille Desmoulins, established the violent journal, *L'Orateur du Peuple.* Commissioned with Barras in 1793 to establish the authority of the convention at Marseilles and Toulon, he distinguished himself equally with his colleagues in the atrocity of his reprisals, but both afterwards joined the Thermidoriens, and F. became the leader of the Jeunesse Doree. He then made his paper the official journal of the reactionists, and being sent by the directory on a mission of peace to Marseilles, he published, in 1796, *Mémoire historique sur la Reaction royale et sur les Malheurs du Midi.* He died in St. Domingo, where he was for a few months sub-prefect.

FRESCO, Fresco-Painting, or Painting in Fresco, the term applied to paintings executed upon plaster while it is still wet or fresh (Ital. *fresco*). Many celebrated artists and well-known writers have maintained that fresco is the only way in which the highest efforts in art should be embodied. A very large proportion of the best works of the Italian schools, particularly those of Rome and Florence, are done in this manner; and during the present century it has been revived, and many of the chief paintings of the modern German school are executed in fresco. The practice has to some extent been introduced into Britain, and certain works of that kind have been executed in the new houses of parliament. Munich has been the chief home of this revived art.

Before noticing more particularly the various properties claimed for fresco-painting, it is proper first to describe the process. A cartoon or drawing on paper is first made of the subject. This must be executed with a correct outline, and the shading and effect fully made out. The finished cartoon may either be of the same size as the intended fresco, or it may be done on a smaller scale; but, at all events, an *outline* of the same size as the fresco-painting is necessary. When the finished cartoon is made the same size as the fresco, it is generally executed in black and white, with chalk or charcoal, but it is essential to have also a careful study of the subject in colors, and this is in most cases done on a small scale. The colors used are mostly earths or minerals, as few others will stand the action of lime: these are ground and applied with pure water. The ground to be painted on is the last or smooth coating of plaster that is laid over the rough plaster-work with which walls are prepared. This last coating, or ground, or rather as much of it as the artist calculates on being able to cover in one day, is laid on immediately before he commences work. The surface is wet, but firm and smooth; the tracing is laid over the portion prepared, and the artist, with a point of hard wood or bone, goes over the lines of the tracing, and slightly indents them on the plaster. He then proceeds with his work, the finished cartoon and colored sketch being hung or placed near him for his guidance. After his day's work is over, any portion of the plaster that has not been painted on, or that may remain beyond or at the edge of his work, is cut away; and next day, when the painter is ready to commence work, the

plasterer is at hand, and joins closely another portion of plaster to the edge of the portion painted on the previous day, which, when cut, had been slightly sloped. The lime, in drying, throws out a kind of crystal surface, which protects the color, and imparts a degree of clearness much superior to, and easily distinguishable from, that of a work in tempera or size paint. This process, although apparently simple, nevertheless requires great dexterity and certainty of hand; for the surface of the plaster is delicate, and must not be overworked, besides, the lime only imbibes a certain quantity of additional moisture in the form of liquid colors, after which it loses its crystallizing quality, and the surface, or a portion of it, becomes what painters call rotten. Many frescos are defective in this way. It is only after the lime has dried that such flaws are discovered; the proper plan, in such a case, is to cut away the defective portion, have fresh plaster laid on, and do the work over again. But the flaws are too often retouched with tempera or size colors; and though they may escape notice for a time, the parts touched will change or come off in the course of a few years. Another difficulty in fresco is, that the colors become much lighter after the plaster dries, and for this allowance must be made. However, by practice, the painter may soon get over this difficulty; and he can test the difference between the color as wet and as dry, by putting a touch on a piece of umber he has generally at hand, which instantly dries the color, and shows it as it will be when the lime has dried.

The pre-eminence claimed for fresco-painting is founded on—1. The quality it possesses of clearness, and exhibiting colors in a pure and bright state. The surface not being dry and dull, as tempera or size color, nor glossy like oil-paintings, is capable of being favorably viewed from any point. 2. Its durability—many frescos being painted on arcades or the cloisters of churches open on one side, some on the fronts of houses entirely exposed in the open air. 3. The skill and dexterity required in execution—retouching not being admissible, nor those various appliances of glazing over painting, etc., available in working with oil-colors; all which circumstances compel the fresco-painter to confine his energy more to the subject and design, than to the mechanical qualities so much sought after by painters in oil. The frescos by M. Angelo in the Sistine chapel, by Raphael in the stanze of the Vatican, and those in the cupola of the cathedral of Parma by Correggio, are pointed to by the advocates of this mode of art as settling the question.

But, on the other side, it may be said—1. Though a certain degree of clearness and purity of color results from fresco, it is deficient in depth and richness. The absence of glossiness is no doubt an advantage in the case of mural-painting with reference to architectural decoration; but to a considerable extent this difficulty can be obviated in the case of painting in oil; and Delaroche's great picture of the Hemicycle in the beaux arts in Paris, which is in oil, is not objectionable on that ground—indeed, many mistake it for fresco. 2. No doubt, in fresco, the colors are not liable to change much, if the work be executed in pure fresco, and not retouched; but, generally speaking, the surface is fragile, and easily broken or scratched, and there is no way of mending it but by retouching with tempera colors; and if that be extensively done, its nature is altered; and it becomes a picture in size colors. The "Madonna de Foligno," "Madonna di San Sisto," "Sposalizia," and other celebrated easel-pictures by Raphael, are in much better preservation than his frescos in the stanze of the Vatican. 3. The properties of difficulty in execution and limited range of coloring, and of technical appliances, are of a negative kind. No doubt, some painters have maintained that good coloring is incompatible with grand compositions; but, on the other hand, Titian's "Entombment" in the Louvre, and Peter Martyr in Venice, among others, are referred to as rebutting such an assertion.

Mural-painting is of great antiquity: in Egypt, in the Etruscan tombs, on the walls of houses in Pompeii, and in the catacombs, there are various remains of paintings which are generally considered to be frescos; those in Pompeii, in particular, are remarkable for grandeur and purity of style in design and drawing; but they are executed in a slight and free manner, and on this account, and from the same or nearly similar subjects being often found repeated, are supposed to be copies by house-decorators of celebrated paintings that were preserved in temples or palaces at Rome. Whether these were frescos painted on the walls or movable pictures, is matter of dispute. "The Greeks preferred movable pictures, which could be taken away in case of fire, or sold if necessary."—Wilkinson on *Egyptian and Greek Paintings*. Pliny says Apelles never painted on walls; and various pictures of immense value are stated to have been taken from Greece to Rome.

On the whole, it may be assumed as an opinion that has long been generally adopted, that where painting is to be combined with architecture, fresco is the style that assimilates most with it. On the other hand, the fact of Delaroche having so successfully executed in the Beaux Arts a work in oil, which by size and subject was so well adapted for fresco, and the circumstance of the adoption lately in Germany, and by the artists in our houses of parliament, of stereochromic painting (see below) in place of fresco—a method by which certain defects in the process of fresco-painting are said to be obviated—militate against the soundness of some of the opinions hitherto adopted as to the advantages ascribed to fresco-painting.

Fresco Secco is a spurious kind of fresco, much used in Italy in ordinary house-deco-

ration. The colors, mixed in water, are laid on the wall after the plaster is dry, and adhere in a certain degree by absorption, the hard or glassy surface which forms on plaster after it dries being first removed by pumice or otherwise. Pictures executed in this manner look coarse and dry, or rotten, and are in every way inferior to pure fresco.

Stereochromic Painting (Gr. *stereos*, firm, and *chroma*, color).—The ordinary process of fresco secco, however, has lately assumed very great importance from a discovery by the late Dr. J. R. von Fuchs of what is called water-glass (see FUCHS'S SOLUBLE GLASS), which, being passed over the surface of a work executed in fresco secco, imparts much brilliancy, and fixes and gives great durability to the colors; this method is styled stereochromic painting, and has been extensively practiced in Berlin by Kaulbach and other eminent German artists. The late prince Albert was so much impressed by the bearing which this discovery would have on the art of mural-painting, that he translated from the German a pamphlet describing the "manufacture, properties, and application of water-glass (soluble alkaline silicate), including a process of stereochromic painting," and printed it for private circulation. Mr. Maclise, R.A., made use of this new style of art in executing his great picture in the palace of Westminster of the "Meeting of Wellington and Blucher at Waterloo."

FRESCOBALDI, GIROLAMO, 1587–1654; a composer of music, b. at Ferrara, of whose life little is known. It is supposed that he went to Belgium, at that time still a center of art, where he is said to have lived till 1608, after which period he appears to have settled in Italy, at first in Milan, and in 1627 in Rome, where three years later he obtained the office of organist of St. Peter's church. At this period he had acquired great fame as a virtuoso on the organ, and according to Baini no less than 30,000 people flocked to St. Peter's on his first appearance there. He also excelled as a teacher, Frohberger, the celebrated organist, and precursor of Bach, being the most distinguished of his pupils. Frescobaldi's compositions show the consummate art of the early Italian school, and his works for the organ especially are full of the finest devices of fugal treatment. He also wrote numerous vocal compositions, such as canzones, motets, hymns, etc., a collection of madrigals for five voices being among the earliest of his published works.

FRESEN'IUS, KARL REMIGIUS, b. Germany, 1818; a chemist and assistant of Liebig. In 1845, he was professor of chemistry at Wiesbaden. In 1862, he founded the *Zeitschrift für Analytische Chemie*. He is the author of valuable works on the mineral springs of Germany. His most important publications are *Anleitung zur Qualitativen Chemischen Analyse*, and *Anleitung zur Quantitativen Chemischen Analyse:* the former having reached a 13th ed., and the latter having been translated into English.

FRESHWATER HERRING. See COREGONUS.

FRESHWATER MUSCLE, a popular name common to a whole family of lamellibranchiate mollusks, *unionidæ* (sometimes called *naiadæ*), allied to muscles (*mytilidæ*), but having a much larger foot, which does not generally produce a byssus (q.v.), except in a very young state of the animal. All the known mollusks of this family are inhabitants of fresh water, some of them being found in still, and some in running waters. A few species are European; but it is in North America that they chiefly abound, its lakes and rivers producing many species. They crawl about by means of the foot; many of them generally live immersed in mud. They are supposed to feed on animalcules, and on decomposed animal and vegetable matter. The epidermis of many is brilliantly colored, and the inside of the shell is lined with a brilliantly and variously colored nacre, so abundant as to be sometimes used for mother-of-pearl. Pearls are sometimes produced. There are four British species, of which one, *anodon cygneus*, attaining a size of 2½ in. long by 6 broad, is common in lakes, ponds, and muddy rivers. It is very variable in the thickness of the shell and in other particulars. The hinge is toothless. Two species are confined chiefly to the s. and e. of England; the fourth (*unio* or *alasmodon margaritifera*, *mya margaritifera* of Linnæus) inhabits the rivers of mountainous and hilly districts with a rocky bed, and has long been celebrated for the pearls which it produces. It is about 2½ in. long by 5 broad, and has a thick blackish-brown shell, with a toothed hinge. It is the most northern European species, and is found in the rivers of Norway and Sweden. The pearls of the British rivers were famous among the ancient Romans; and Suetonius represents them as having formed an inducement for Cæsar's expedition. Some of the rivers of Wales, the n.w. of England and Scotland, have at various times produced beautiful and valuable pearls. In several of the rivers and lochs in Perthshire, muscle-gathering is quite a trade, and the pearls found form the means of subsistence to many families. A pearl from the Conway, presented by sir Richard Wynn to the queen of Charles II., is among the ornaments of the British crown. Large and fine pearls have also been procured from rivers of Tyrone and Donegal.

FRESHWATER STRATA are so named from their supposed origin. This can be easily determined from an examination of the contained fossils. Though the great proportion of aqueous rocks are of marine origin, yet F. S. strata are occasionally met with. The yellow sandstones of the old red or lower carboniferous period are freshwater beds, as are also the Burdie-house limestone in the Edinburgh coal-field, the Pur-

beck beds in the oolite, the wealden beds in the chalk, and the Hempstead and other beds in the eocene period.

FRESNEL, AUGUSTIN JEAN, a French physicist, was b. at Broglie, in the department of Eure, 10th May, 1788, educated at Caen at the Ecole Polytechnique, and finally at the Ecole des Ponts et Chaussées. On the completion of his studies, he was sent as government engineer to La Vendée, and afterwards to the department of Drôme, where he remained till Mar., 1815. On the return of Napoleon from Elba, F. offered his services to the Bourbons, but ill health prevented him from actively engaging in military life. At the restoration, he resumed his duties as government engineer; but in the interval he had been devoting his enforced leisure to physico-mathematical researches, particularly the polarisation of light, with so much success, that although in a letter, dated 28th Dec., 1814, we find him writing to a friend to get him some books on the subject, as he did not know what the phrase "polarization of light meant" ("Je ne sais ce qu'on entend par la polarisation de la lumière"), yet before the completion of the following year, he ranked among the first authorities on the question. In ignorance, it is said, of the labors of Young, F. demonstrated to his countrymen the error of the Newtonian theory of the propagation of light by the emission of material particles, and ably advocated the undulatory hypothesis. The result of his researches was exibited in a memoir, crowned by the French académie des sciences in 1819. Along with Arago, he investigated the action exercised by polarized rays of light on each other, and their discoveries, published in a joint memoir, confirmed his previous theory on the mode of the propagation of light. His practical application of the new theory to the improvement of the light-house system, was of incalculable value, and has quite abolished the old method of illuminating light-houses. See LIGHT-HOUSES. In 1823, F. was elected a member of the académie des sciences; in 1825 a member of the royal society of London; and in 1827, received from the same society the Rumford medal for his discoveries concerning light and heat. He died July 14, 1827.

FRESNIL'LO, a mining t. of Mexico, in the state of Zacatecas, 30 m. n.w. from Zacatecas, on a feeder of the Santiago or Tololatlan. It has a spacious square, in the center of which is a splendid fountain. In the neighborhood are silver and copper mines, which are among the most productive in Mexico. Pop. 12,000.

FRESNO, a co. in central California between the Sierra Nevada and the coast range of mountains, intersected by the San Joaquin, Fresno, and King rivers, and the Central Pacific railroad; area, 8,750 sq.m.; pop. '70, 6,336. The surface is rough but fertile, and there are rich mines of quicksilver and of silver. Co. seat, Millerton.

FRET, a figure, in heraldy, resembling two sticks laid saltierwise, and interlaced with a mascle.

FRETTY. When six, eight, or more pieces are represented crossing and interlacing like lattice-work, the shield is said to be fretty.

FREU'DENSTADT, a t. in Würtemberg, and capital of a bailiwick of the same name, in the circle of the Black Forest, 40 m. s.w. of Stuttgart, is situated on a rock which is washed by the Murg. It was founded in 1599 by duke Frederic I., and peopled by Protestant refugees from Austria. It has a considerable trade in wood, cattle, and fruit. Cotton-spinning, weaving, bleaching, smith-work, especially making nails, etc., are the principal industries. The town is regularly built. It has a good market-place, with arcades, and a grammar-school. The environs are beautiful, and present many interesting prospects. Pop. '75, 5,325, nearly all Protestants.

FREUND, WILHELM, b. 1806; a German lexicographer of Hebrew descent, educated in Berlin, where he opened a Hebrew school. He assumed the direction of schools in various places. He has published several works, the most important being his *Wörterbuch der Lateinische Sprache*, from which Andrew's Latin lexicon is mostly compiled.

FREYCINET, LOUIS CLAUDE DESAULSES DE, 1779–1842; an officer of the French navy and a noted navigator. He took part in several engagements against the English, and, in 1800, he joined with his brother Henry Louis, who afterwards rose to the rank of admiral, the expedition sent out under capt. Baudin in the *Naturaliste* and *Géographe* to explore the s. and s.w. coasts of Australia. Much of the ground already explored by Flinders was revisited, and new names imposed by this expedition. In 1805, Louis returned to Paris, and was intrusted by government with the work of preparing the maps and plans of the expedition. In 1817, he commanded the *Uranie*, in which Arago and others went to Rio de Janeiro, to take a series of pendulum measurements. This was only part of a larger scheme for obtaining observations, not only in geography and ethnology, but in astronomy, terrestrial magnetism, and meteorology, and for the collection of specimens in natural history. For three years Freycinet cruised about, visiting Australia, the Marianne, Sandwich, and other Pacific islands, South America, and other places, returning to France, notwithstanding the loss of the *Uranie*, with fine collections in all departments of natural history, and with voluminous notes and drawings which form an important contribution to a knowledge of the countries visited. The results of his voyage were published under Freycinet's supervision, with the title of *Voyage Autour du Monde*, etc.—[From *Encyc. Brit.*, 9th ed.]

FREYJA AND FRIGGA, though spoken of in northern mythology as distinct, are originally one, and intimately associated with Freyr. Frigga, in the genealogy of the Ases (q.v.), is the supreme goddess, wife of Odin, and one of the daughters of the giant Fiörgwyn, and presides over marriages. Freyja is the daughter of Niord, sister of Freyr, and goddess of love. She is drawn on a car yoked with cats; to her, deceased women go, and also the half of those that fall in battle, whence she is called Val-Freyja. In this last respect, she must be considered as signifying the earth; but the earth is also represented by Frigga, the wife of Odin, and when Freyja seeks Odin, as Isis seeks her Osiris, this is Odin conceived as the Sun. The names also, Frigga and Freyja, are in signification almost alike, and the two are often confounded in mythology. The Anglo-Saxons and Lombards worshiped the wife of Odin as Frea. The name yet survives in *Friday*.

FREYR, the son of Niord, of the dynasty of the Vanagods, was adopted with his father among the Ases, who, when he got his first tooth, bestowed upon him the celestial castle Alfheim. He is the god of peace and fertility; dispenses rain and fertility; and to him prayers for a good harvest are addressed. His wife is Gerda, daughter of the giant Gymer. F. had seen her as he once ascended the lofty seat of Odin, Hlidskialf, from which everything on earth is seen. Gerda was so beautiful, that the brightness of her naked arms illuminated air and sea. Seized with violent love, F. sent Skirnir as spokesman, and for his services had to give him his good sword, which he will miss in the great final contest or eclipse of the gods. Like Freyja, he was the patron of marriage, and probably the two were at one time conceived as united, hermaphroditewise. F. was held in great veneration, especially in Sweden, of which he was patron-god, and also in Iceland. His chief temple was at Upsala, where a bloody offering was yearly made to him of men and animals. His festival was at the winter solstice, the turn of the year—Yule-tide. While the god was borne round the land, all strife was laid aside. (Does "the procession of the boar's-head," at Christmas-time, commemorate F., who rode on the boar, Gullinbursti, and whose symbol was the boar's head?) The circumstance that the Saxon form of F.'s name, Fro, has been preserved in the German name of a Christian festival, Fronleichnam (Corpus Christi, the Lord's body), seems to show that it had become among these peoples the abstract term for a god.

FREY'STADTEL, FREYSTADT, or (Hung.) GALGOCZ, a *t.* of Hungary, in the circle of Neutra, 84 m. n.w. from Pesth, on a height above the left bank of the Waag, opposite to Leopoldstadt. The Waag is here crossed by a long bridge. F. contains a fine castle belonging to count Erlody, situated on a steep limestone cliff, with fine gardens. There is also a curious round tower, supposed to have been a Turkish minaret. Various articles of wood are extensively manufactured. There are important cattle-markets. Pop. '69, 6,346.

FREYTAG, GEORG WILHELM FRIEDRICH, 1788–1861; b. Germany, and educated at Göttingen in philology and theology. From 1811–13, he acted as tutor there; but at the end of 1813, became sub-librarian at Königsberg. In 1815, he accepted the office of chaplain in the Prussian army, and in that capacity visited Paris, where he had ample opportunities for the cultivation of his favorite oriental studies. On the proclamation of peace he resigned his chaplaincy, but, with the sanction and support of his government, continued his researches in Arabic, Persian, and Turkish at Paris, under De Sacy. In 1819, he was appointed to the professorship of oriental languages in the recently established university of Bonn, and this post he continued to hold until his death. He edited two volumes of Arabic songs and three of Arabic proverbs. But his principal work was the laborious and praiseworthy *Lexicon Arabico-Latinum*, which rapidly superseded the earlier lexicons, and which remained long in current use as embodying the best results of the labor of De Sacy and his school.

FREYTAG, GUSTAV, a dramatic poet and novelist of Germany, was b. 13th July, 1816, at Kreuzburg, in Silesia, studied at the universities of Breslau and Berlin, and took his degree in philosophy in 1838. His first important work was a comedy, entitled *Die Brautfahrt, oder Kunz von Rosen* (Breslau, 1844). Among his other productions may be mentioned *In Breslau* (Berlin, 1845), which is a collection of small poems written in a popular style; the dramas *Die Valentine* (Leip. 1847) and *Graf Waldemar* (Leip. 1848); and the comedy entitled *Die Journalisten* (1854). An edition of his dramatic works was published at Leipsic, in 3 vols., 1848–50. But his greatest achievement in literature is undoubtedly *Soll und Haben* (Leip. 1855), a novel of German citizen-life. It has been translated into English by Mrs. Malcolm under the title of *Debit and Credit* (1858). In 1859, F. published a new classical drama, *Die Fabier*. A series of prose pictures from German history, entitled *Neue Bilder aus dem Leben des Deutschen Volkes* (Leip. 1862; Eng. trans. *Pictures of German Life*), followed the series *Bilder aus der Deutschen Vergangenheit*. *Die Verlorne Handschrift* (*The Lost Manuscript*) appeared in 1864. The series of tales called *Die Ahnen* includes *Ingo und Ingraban; Das Nest der Zaunkönige; Die Brüder vom Deutschen Hause;* and *Markus König* (1876). F. has also written on the rules of the drama. In 1870, he retired from the editorship of the *Grenzboten*, which he had conducted for twenty-three years, and became the editor of a weekly magazine published at Leipsic.

FRIAR, a name common to the members of certain religious orders in the Roman Catholic church, and generally employed in contradistinction to the name monk and regular clerk (see these articles). The name F., although from its etymology (*frère*, brother) it belongs to the members of all religious brotherhoods, yet has come to be reserved almost exclusively for the brethren of the mendicant orders. It is applied chiefly to the four great orders, Dominicans, Franciscans, Augustinians, Carmelites, and later, to the Trinitarians, and to the various branches of these orders. The Franciscans were properly denominated "friars minor" (*fratres minores*). The Dominicans received, in contrast, the title "friars major," which, however, was perhaps rather a sobriquet than a serious name. These several bodies of friars, too, were popularly called, from the color or other peculiarity of their habit, gray friars (Franciscans), black friars (Dominicans), white friars (Carmelites) crutched, [or crouched (*cruciati*, "crossed")] friars (Trinitarians), so called from the cross which was embroidered upon their habit. This is the origin of the names of the several localities in London, and other towns thus designated, to the present day. In the orders to which we refer, the friars who are in priest's orders are styled "father." The other members are called simply "brother." The vow taken by friars at profession is of the class called in the Catholic church "solemn," and is held to render null and void any contract of marriage entered into by the party subsequently to his religious profession.

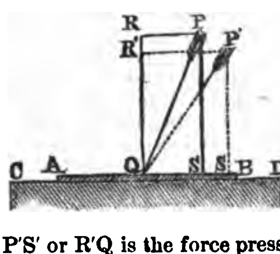
FRIARS' BALSAM. See BENZOIN.

FRICTION. When one body rubs against another as it moves, a certain force is felt to resist the motion. This resistance is called *friction.* As a considerable proportion of the motive-power in all operations is spent in overcoming the F. of the parts of the machine upon one another, and is thus lost for the useful work, it is of great importance to understand the nature of this obstructive force, with a view to reduce it to the least possible amount. Accordingly, a great many careful experiments have been made on this subject, and the result is a number of precise and valuable facts or laws regarding friction, which are now considered certain and reliable. The more important may be thus stated and illustrated.

When a block of oak—say a cubic foot, which weighs about 60 lbs.—is placed on a horizontal table of cast iron, the two surfaces being flat and smooth, it requires a force of nearly $\frac{2}{5}$ the weight of the block, or 24 lbs., pulling horizontally, to make it slide along the table. This measures the F. between the two surfaces. Another block of the same size and shape laid on the same table, would require the same force to draw it; and if the two were laid side by side, and fastened together so as to become one block, it would evidently require double the force, or 48 lbs., to draw the double block; the amount of the F. being thus still $\frac{2}{5}$ of the weight, or of the pressure between the two surfaces. But suppose that, instead of being laid side by side, the second block were laid on the top of the first, what is to be expected? Here the weight is doubled as before, but the extent of rubbing surface remains unaltered; it would be natural, therefore, to expect that this would make a difference, and that, though the F. would, of course, be increased, the increase would be less than in the former case. Experiment, however, shows that there is no difference, and that the F. is just double in both cases. In short, the unexpected and important fact is established, that, *within certain limits, the F. of any two surfaces increases in proportion to the force with which they are pressed together, and is wholly independent of the extent of the surfaces in contact.*

The amount of F. between two bodies is thus a constant fraction or proportion of the force with which they are pressed against each other. This fraction differs for the different kinds of surfaces. Thus, between oak and cast iron, it is, as already stated, about $\frac{2}{5}$, or more exactly, .38; for wrought iron on wrought iron (we speak at present of dry surfaces, without grease or unguent of any kind), it is .44; for brass upon cast iron, .22. This constant fraction (expressing the proportion between the pressure of two surfaces and their F.) is called the *coefficient of F.* for these two surfaces.

Another way of illustrating this law of F. is the following, which has an important bearing on the erection of structures, and on mechanics in general. Suppose a slab AB, in contact with another slab CD, of the same or of different material; and that a force PQ presses on AB obliquely. Let QR be the perpendicular to the two surfaces, and draw PR, PS parallel to AB and QR, thus resolving the force PQ into two forces, one, PS, pressing AB against CD, the other, PR or SQ, tending to make AB slide towards C. It will clearly depend upon the strength of F. between AB and CD, how far the force PQ may be made to decline from the perpendicular without actually causing the one body to slide on the other. Suppose that when the pushing force is brought into the position P'Q, AB is just ready to slip on CD, and that it is a case of oak upon iron; then, since P'S' or R'Q is the force pressing the surfaces together, and P'R' or S'Q the force tending to produce motion, P'R' will be $\frac{2}{5}$ of R'Q. The angle P'QR' is called *the limiting angle of resistance* of the two surfaces AB, CD; for so long as the direction of the pressure PQ is within that angle,



the F. of the surfaces will sustain it; but if the obliquity is greater, the surfaces will slip. This is true, independently of the extent of the surfaces in contact; and also of the amount of the pressure; for the stability depends upon the proportion of PR to RQ, and that is the same, whatever is the length of PQ, so long as its inclination is the same.

If the slab CD were tilted up, so as to form an inclined plane, until AB were on the point of sliding, the angle of inclination would be found to be equal to the limiting angle of resistance RQP'.

Knowing the coefficient of F. of any two substances, their limiting angle of resistance is easily found. *Example.*—The coefficient of brick upon hard limestone is .60; required the limiting angle. Take a line QR' of any convenient length, raise a perpendicular R'P' equal to $\frac{6}{10}$ of QR', and join QP'; R'QP' is the angle required: if measured, it would be found to be about 31°. In any structure, then, the obliquity of the thrust between two surfaces of these materials must always be considerably within this limit, in order to be safe.

The *friction of quiescence*, that is, the resistance to the commencement of motion, is greater than the resistance to its continuance; and the more so if the surfaces have been a considerable time in contact. But the slightest shock or jar is sufficient to destroy this cohesion, or whatever it is that constitutes the peculiar initial resistance; so that it is only the constant and regular F. of motion that is of much consequence in practice.

F. is very much diminished by the use of grease or unguents. The coefficient of wrought-iron upon oak, which, in the dry state, is .49, is reduced by the application of water to .26, and by dry soap to .21. The result of experiments on this subject is stated to be, "that with the unguents, hog's-lard and olive-oil, interposed in a continuous stratum between them, surfaces of wood on metal, wood on wood, metal on wood, and metal on metal (when in motion), have all of them very nearly the same coefficient of F., the value of that coefficient being in all cases included between .07 and .08." Tallow gives the same coefficient as the other unguents, except in the case of metals upon metals, in which the coefficient rises to .10. In the case of wood on wood, black-lead is frequently employed for the same purpose.

The most important fact, perhaps, and one that could hardly have been anticipated before experiment, is *that the F. of motion is wholly independent of the velocity of the motion.*

The resistance to the motion of a wheeled carriage proceeds from two sources; the F. of the axle, and the inequalities of the road. The resistance of F. to the turning of a shaft in its bearings, or of an axle in its box, has evidently the greater leverage, the thicker the journal or the axle is; the axles of wheels are accordingly made as small as is consistent with the required strength. The resistance that occurs between the circumference of the wheel and the road, constitutes what is called *rolling* friction. There are on all roads, to a greater or less extent, visible rigid prominences, such as small stones, in passing over which the wheel and the load resting on it have to be lifted up against gravity. But even were these wanting, the hardest road yields, and allows the wheel to sink to a certain depth below its surface; so that in front of the wheel there is always an eminence or obstacle, which it is at every instant surmounting and crushing down. This is the case even on iron rails, though of course to a much less extent than on any other road. Now, for overcoming this resistance, it can be shown, on the principle of the lever, that a large wheel has the advantage over a small one; and by numerous experiments, the fact has been fully established, that on horizontal roads of uniform quality and material, *the traction varies directly as the load, and inversely as the radius of the wheel.*

The best direction of traction in a two-wheeled carriage is not parallel to the road, but at a slight inclination upward, in proportion to the depth to which the wheel sinks in the road.

On a perfectly good and level macadamized road, the traction of a cart is found to be $\frac{1}{30}$ of the load; that is, to draw a ton, the horse requires to pull with a force equal to 75 lbs. On a railway, the traction is reduced to $\frac{1}{280}$ of the load, or to 8 lbs. per ton.

While F. thus acts as an obstruction to motion, and wastes a portion of the motive-power, it has also important uses. It is, in fact, an indispensable condition, no less than gravity, in the stability of every structure, and in every mechanical motion on the earth's surface. How essential it is to our own movements, we experience when we try to walk on ice. Even on ice there is still considerable F., so that one foot can be slightly advanced before the other; were it altogether annihilated, we could not stir a fraction of an inch, even supposing we could stand upright. Without F., a ladder could not be planted against a wall, unless there were a hole in the ground to retain the foot. In short, no oblique pressure of any kind could be sustained. The advantage of railways consists chiefly in the diminution of F.; but were this diminution carried much further, there could be no motion whatever, at least by means of locomotives. Without considerable F., the driving-wheels of the locomotives would slide round on the rails without advancing; and this sometimes happens, when particular states of the weather render the rails as if they were greased.

The force of F. is often directly employed in mechanics. It is used, for instance, to communicate motion by means of belts, chains, etc. It is the force that holds a knot. It is specially useful when a machine, with great momentum, has to be checked or

arrested in its motion. The best example of this is the *break* used on railways. By means of a system of levers, blocks of wood are made to press against the circumferences of a number of the carriage-wheels; and thus the momentum of a train weighing hundreds of tons, and moving with a velocity of perhaps 50 m. an hour, is gradually destroyed in a wonderfully short space of time.

Friction-wheels are employed to diminish the F. of axles on their supports. Two wheels, of large circumference in proportion to their weight, are placed close together, parallel to each other, and so that the one seems to overlap the half of the other; in the notch thus formed by the upper circumferences of the wheels one end of the axle rests; a similar arrangement being made for the other end. The F., which formerly acted directly on the axle, is by this arrangement referred to the axles of the friction-wheels, and is, by the laws of mechanics, reduced in the ratio of the circumference of the friction-wheel to the circumference of its axle. In order to render the F. of the friction-wheels themselves the least possible, they are made as light and as large as is practicable.

FRIDAY, the sixth day of the week. In the Roman Catholic and some of the eastern churches, all Fridays except Christmas are obligatory fast days in memory of the crucifixion of Christ, which is commemorated on what is called Good Friday. In some Roman Catholic communities Fridays in Advent are exempt from this rule. Ember day in Advent, however, is always a fast. The superstition that Friday is an "unlucky day" may probably be traced to the early Christian celebrations in memory of the crucifixion. See DAYS, UNLUCKY.

FRIEDEBERG, a walled t. of Prussia, in the province of Brandenburg, 56 m. n.e. from Frankfort, on the Peza. Around it are several lakes. It has woolen manufactories and tanneries, and some trade in cattle. Pop. '75, 5,805.

FRIEDLAND, a small t. of e. Prussia, in the circle of Königsberg, situated on the left bank of the Alle, 26 m. s.e. of Königsberg, in lat. 54° 26′ n., and long. 21° east. Pop. '75, 5,086, who are employed in linen-weaving. F. has been rendered famous by the victory obtained there by Napoleon, 14th June, 1807, over the Russian forces under Bennigsen. The Russian gen. found himself unable to cope successfully with an army of 80,000 men, as his own force consisted of less than 50,000 horse and foot; and he was forced to retire after a disastrous battle. He fell back upon the town of Tilsit, on the Niemen, where the treaty between the French and Russian emperors and the king of Prussia, known as the treaty of Tilsit, was drawn up.—FRIEDLAND is also the name of a town in Bohemia, situated on the Wittig, near the Prussian border. It is the capital of a district or duchy of the same name, from which the famous Wallenstein (q.v.) took his title of duke of Friedland. Pop. of the town, 1869, 4,482.

FRIEDLAND, VALENTIN, generally called, from his birthplace, *Trotzendorf*, and indisputably the greatest educationist of his age, was a native of upper Lusatia, and was born 14th Feb., 1490. After the death of his father, in 1518, he went to Leipsic, where he studied under the celebrated Peter Mosellanus and Richard Crocus, acquiring among other things a knowledge of Greek. On the dawn of the reformation, he proceeded to Wittenberg, where he formed a close intimacy with Luther and Melancthon, and learned Hebrew from a converted Jew. In 1523, he proceeded to Goldberg, in Silesia, as rector of the gymnasium there; left after four years, but returned in 1531, and exhibited the greatest energy in improving the organization of the school. Success crowned his efforts. The gymnasium of Goldberg acquired a rare celebrity. Not only from Silesia, but also from Poland, Lithuania, Austria, Bohemia, Hungary, and Transylvania, pupils sought it in great numbers. Often more than 1000 attended at a time, who all dwelt together in buildings set apart for the purpose, and were admirably superintended and drilled. F. had a most wonderful belief in the efficacy of knowledge, and, in particular, placed so high a value on clearness of thought and expression, that he was wont to affirm that only rogues were unintelligible, and that an obscure and confused diction was a sure sign of a knavish disposition. He died at Liegnitz, 26th April, 1556. Compare Pinzger's *Valentin Friedland* (1825), and the biography by Löschke (1856).

FRIED'LÄNDER, DAVID, 1750–1834; b. Prussia; a Hebrew scholar, who became a leader of the Jews at Berlin in various reforms. He proposed to the Prussian ecclesiastical authorities the admission of Jews to the Christian church without their acknowledgment of the divinity of Christ, but his proposition was not favorably received, though its discussion produced a literature of considerable extent. He established a free school for the Jewish youths at Berlin, and labored long and earnestly for the advancement of his race.

FRIEDRICH, JOHANN, b. Germany, 1836: a German theologian, ordained a Roman Catholic priest in 1859; in 1865, professor of theology in the university of Munich, and in 1867 a member of the academy of sciences. The most noticeable of his works is the *Kirchengeschichte Deutschlands*. He contributed a great many articles to the *Allgemeine Zeitung*, in which he advocated principles adverse to the Vatican, for which he was excommunicated and formally suspended. The latter being adverse to the Roman church, he with Döllinger received the major excommunication. He has published several other works opposed to the extreme pretensions of the papacy.

FRIENDLY ISLANDS, as distinguished from the Fiji islands (q.v.), generally reckoned a part of them, are otherwise styled the TONGA GROUP. They stretch in s. lat. from 18° to 23°, and in w. long. from 172° to 176°, and consist of about 32 greater and 150 smaller islands, about 30 of which are inhabited. The great majority are of coral formation; but some are volcanic in their origin, and in Tofua there is an active volcano. The principal member of the archipelago is *Tongatabu* or *Sacred Tonga*, which contains about 7,500 inhabitants, out of a total population of about 25,000. The F. I. were discovered by Tasman in 1643, but received their collective name from Cook. Both these navigators found the soil closely and highly cultivated, and the people apparently unprovided with arms. The climate is salubrious, but humid; earthquakes and hurricanes are frequent, but the former are not destructive. Among the products of the islands are yams, sweet-potatoes, bananas, cocoa-nuts, bread-fruit, sugar-cane, the *ti*, hog-plum, etc.; some corn also is grown. The flora resembles that of the Fiji group; but the native animals are very few.

The F. I. were first visited by missionaries in 1797. In 1827, the work of evangelization fell into the hands of the Wesleyan Methodists, and after a lengthened and perilous struggle with the savage paganism of the inhabitants, it was crowned with success. Almost all the islanders are now Christians; great numbers can speak English, and, in addition, have learned writing, arithmetic, and geography; while the females have been taught to sew. The various islands used to be governed by independent chiefs, but nearly the whole of them are now under the rule of one chief, called king George, who is not only a Christian, but a zealous preacher of the gospel.

FRIENDLY SOCIETIES. The uncertainties of human life and health, and the effects of these on the well-being of those who are dependent for their subsistence on human labor, are too manifest not to have arrested the attention of men in all ages, and to have taxed their ingenuity to guard against them. It is probable, therefore, that traces of some sort of institution, corresponding more or less closely to the F. S. of modern Europe, might be found wherever mankind have not depended for their means of living on the spontaneous products of the soil. At all events, they had their prototypes in the cases, boxes, and chests, or kists—as they were called in Scotland and Germany—of the guilds and corporations of mediæval Europe; which were funds not only for maintaining the dignity and ministering to the conviviality of the members, but for providing for the aged and the sick. Mr. Turner finds them in Anglo-Saxon England, and, like the other institutions connected with municipal life, they probably formed part of the legacy of the Romans to the Teutonic conquerors of Europe. F. S. are a form of mutual insurance, and, like all insurances, they depend on the principle of substituting the certainty which attends the fortunes of large numbers of men for the uncertainty which belongs to the fortune of each. Their main objects are the securing, in virtue of a small periodical payment during health and vigor, of a weekly sum during sickness, a sum to cover funeral expenses at death, and sometimes of a pension after a certain age. In some respects, therefore, joining a friendly society is better than becoming a depositor in a savings-bank. Sickness may come before the savings are considerable; or, if considerable, they may be melted away by a long-continued sickness; but after the first weekly payment is made to a friendly society, the member is secure of succor, at least for a time, and he has, perhaps, other advantages. It is possible, on the other hand, that a difficulty may be experienced, in certain circumstances, in keeping up the weekly or other periodical payments required, and in this case, in most societies, he altogether forfeits the expected benefits.

It is to be regretted that, of this excellent class of institutions, many are founded upon erroneous principles, or rather upon no principles at all; and it often happens, therefore, that those who trust to them are disappointed, the funds falling short before all claims are satisfied. This was at one time not to be wondered at, as no proper calculations for F. S. existed; but such is no longer the case, sound calculations being now attainable. The most important observations on the average amount of sickness incident to human life are those made by the Highland society, Mr. Charles Ansell, Mr. Finlaison on behalf of the government, Mr. F. G. P. Neison, and the Manchester unity of odd-fellows. The first two were formed on data too limited to be of much value; those of the government were rendered practically worthless by an arbitrary definition of sickness, which made them uncertain for youth and maturity, and deprived them of all authority in reference to old age. The calculations of Mr. Neison and the odd-fellows are based on by far the greatest number of cases, and though investigated by the former in relation to the five years ending 1840, and by the latter in relation to a period precisely twenty years later, they corroborate each other almost completely. We give the estimate arrived at by Mr. Neison of "sickness experienced in *weeks* in passing through different periods of life:" 20 to 30, 8.7; 30 to 40, 9.9; 40 to 50, 14.8; 50 to 60, 27.1; 60 to 65, 26.6; 65 to 70, 50.7; 70 to 75, 84.9; 75 to 80, 120.5.

One great mistake in the formation of F. S. is to assume that each member should pay an equal sum, whatever his age may be. This is unjust to the younger members, who are less likely to become burdensome to the funds than the middle-aged; and, indeed, there is a rising scale of probability of sickness throughout all the years of a man's life. It is, however, well to remember that as sickness varies more considerably

than mortality with the salubrity of the localities inhabited and the occupations of the members, no absolute reliance can be placed on published averages. All of them, however, agree in this, that *increase of years is attended by increased liability to sickness*. Now, a rightly constituted friendly society is bound to take this circumstance into account. To admit all ages at an equal payment, is clearly making the younger members pay for the elder.

Another great error in the constitution of benefit societies is in making them for a year only. These *yearly societies* are to be found in almost every colliery in the n. of England, and are popular among the less intelligent of the people. The objects are generally a fund for sickness and funeral expenses, a deposit fund, and sometimes a loan bank. Towards the first, there is perhaps a weekly payment of twopence or threepence, together with the interest arising from the loan of money to the members. Towards the deposit fund there is a payment ranging generally from sixpence to two shillings, the accumulations being received back when the society closes. The money deposited is employed in making loans to such of the members as desire such accommodation, within the amount of their several entire deposits for the year, one penny per pound per month being charged by way of interest. The surplus, if any, of the twopences and interest, after sick and funeral money, books, and other necessaries are paid, is divided amongst those members who may be clear of the books at the close of the society. In some instances, only three fourths of the funds are divided, and the members commence another year with the balance; but this only happens when they are all in good health. Nothing of the kind would occur if one or more of the number were likely to suffer more than the ordinary rate of sickness. Then the healthy members join other societies, and leave the sick to take care of themselves. In any case, they are so left at the end of the year as no society will receive them. Yearly societies are, indeed, in every point of view a most objectionable class of institutions, to which working-people would never resort except through ignorance.

A well-constituted friendly society involves, in the first place, the principle of payments appropriate to particular ages, as no other plan can be considered equitable. It stands forth before the working-classes as a permanent institution, like the life-assurance soeieties of the middle and upper classes, and necessarily requires its members to consider the connection they form with it as an enduring one, because its grand aim is expressly to make provision, at one period of life, for contingencies which may arise at another—for youth, in short, to endow old age. By a yearly society, a man is left at last no better than he was at first, as far as that society is concerned; but the proper friendly society contemplates his enjoying a comfortable and independent old age, from the results of his own well-bestowed earnings.

It is essential to the character of a proper benefit society that individuals be not admitted indiscriminately. To take a person in bad health, or of broken constitution, is unjust to those members who are healthy, because he is obviously more likely to be a speedy burden upon the funds. Here, as in life-assurance societies, it is necessary to admit members only upon their showing that they are of sound constitution and in good health, And it may be well to grant no benefits until after the member has been a year in the society. By these means, men are induced to enter when they are hale and well, instead of postponing the step until they have a pressing need for assistance, when their endeavor to get into a benefit society becomes little else than a fraud.

Under the sanction of government, tables have been formed by Mr. John Tidd Pratt, late registrar of F. S., in England, and by Dr. Farr, the actuary of the English registrar-general. The former, together with useful instructions in the book-keeping of F. S. are embodied in the reports by Mr. Pratt, printed by order of the house of commons for the years 1856–57; and the latter, together with a masterly essay on the mathematical treatment of the subject, are contained in the 12th report of the registrar-general. On the imperative necessity of acting on correct tables for such a purpose, it would be superfluous to dwell; and the necessity of identifying the rates of any society with such responsible authority is the more apparent, as we are told by Mr. Pratt that "although the registrar certifies to the *legality* of the rules of a friendly society, *it does not follow as a necessary consequence that the constitution of the society is based on good principles*, or that the rates of payment are sufficient in amount to guarantee the promised benefits and allowances." In fact, there are large numbers of insolvent societies, whose rules have been certified in the most regular manner. It cannot be too much insisted upon that the registrar's certificate is absolutely worthless as a guarantee of safety.

We have an idea of a benefit society in its simplest form, if we suppose a hundred men, of 35 years of age, to associate, and make such a payment at first as may be sure to afford each man that shall fall sick during the ensuing year 1*s.* a day during the term of his sickness. Taking, for the sake of illustration, Mr. Neison's tables, we find that, amongst such a body of men. there will be nearly 100 weeks of illness in the course of the year. This, multiplied by 7, gives the whole sum required, £35, or 7*s.* each, which, less by a small sum for interest, will accordingly be the entry-money of each man. A society of individuals of different ages, each paying the sum which would in like manner be found proper to his age, would be quite as sound in principle as one on the above simple scheme. It is only a step further to equalize each man's

annual payments over the whole period during which he undertakes to be a paying member.

A point for consideration, however, is the rate at which the funds of the societies may be improved. In many cases, it is best to rest content with depositing the money in the funds or the savings-banks, in which case they are sure to obtain for it interest at a rate of not less than £3 0*s.* 10*d.* per cent per annum, or twopence per cent per day. Some of the societies have sums invested with the commissioners for the reduction of the national debt, at threepence and twopence-half-penny per cent per day. Many of them invest with local building societies, some in corporation debentures, and in many other ways which afford a better rate of interest with safety; and the tendency to abandon the old routine of merely savings-bank deposit seems rapidly and generally growing.

By the act 27 and 28 Vict. c. 43, government gave to the working-classes an opportunity of effecting small life-insurances, or of purchasing immediate or deferred monthly allowances or annuities, in a manner absolutely free from risk, as the credit of the nation itself is pledged to meet the obligation purchased by the subscriptions or payments of the contributor. A great number of people have availed themselves of the new facilities, but it is probable that very many more would have done so had the scale begun at a lower and been continued to a higher point. At present, no life can be insured for less than £20, or for more than £100. Now, many people are willing enough to insure for as much as will cover their funeral expenses, say for £10, who would not be disposed to make further provision for their families. This class, and it is not a small one, is practically excluded from the benefit of the government system, and it would be well, in future legislation, to reduce the minimum to at least half its present amount. At the same time, the maximum might be safely increased to £200 without interfering with the legitimate business of life-assurance companies.

These government insurances are effected through the agency of the post-office. A list of officers authorized to act may be obtained at any post-office, and at the places so authorized all necessary information and forms of proposal may be had. There also, when filled up, the forms of proposal may be delivered. The premiums charged vary with the age, but not with the sex, of the person to be insured, and the mode in which they are to be paid. For example, the life of a man or woman in his or her 30th year may be insured for £100:

By a single payment of	£48	8	7
By an annual payment throughout life of	2	6	7
By a quarterly payment throughout life of	0	18	0
By a monthly payment throughout life of	0	4	4
By a fortnightly payment throughout life of	0	2	2
By an annual payment until the age of 60 of	2	13	10
By a quarterly payment until the age of 60 of	0	15	0
By a monthly payment until the age of 60 of	0	5	0
By a fortnightly payment of	0	2	6

Smaller sums may be insured by proportionate payments, but no one payment must be less than two shillings.

If after five years' payments the insurer desires, or is compelled by circumstances, to discontinue his insurance, a portion of the premiums, not being less than one third, will be returned to him.

The sums charged for the purchase of *immediate* annuities vary with the *age and sex* of the person on whose life the annuity is to depend. Thus a man aged 65 can purchase an *immediate* annuity of £10, payable half-yearly, for £88 18*s.* 4*d.*; a woman of the same age can purchase a like annuity for £103 16*s.* 8*d.* A man aged 70 can purchase an immediate annuity of £10, payable half-yearly, for £73 3*s.* 4*d.*; a woman of the same age can purchase a like annuity for £84 19*s.* 2*d.*

The sums charged for the purchase of *deferred* annuities, or *deferred* monthly allowances, also vary with the *age and sex* of the annuitant, with the number of years which are to pass before the commencement of the annuity, and with the conditions of the contract as to the mode of purchase, mode of payment, and return or non-return of purchase-money.

When no part of the purchase-money is to be returned, a man aged 30 may purchase a deferred annuity of £10, to commence on his reaching the age of 60, and to be payable half-yearly, either by an immediate payment of £24 3*s.* 4*d.*, or by an annual payment, until he reaches the age of 60, of £1 8*s.* 4*d.* A woman of like age may purchase a like annuity by an immediate payment of £32 8*s.* 4*d.*, or an annual payment up to 60 of £1 17*s.* 6*d.*; and a man aged 30 may purchase a deferred allowance of £2 7*s.* 3*d.* per month, to commence when he reaches the age of 60, by a payment until he reaches that age of 8*s.* per month; and a woman aged 30 may, by a like payment, purchase a deferred allowance of £1 16*s.* 7*d.*, also to commence at 60.

Purchasers of annuities are permitted to elect whether the purchase-money shall be returned to their representatives in case of death before reaching the stipulated age, or to themselves in case of desiring for any reason to withdraw from the arrangement; but for this privilege, they must pay a higher price. Thus, instead of the £24 3*s.* 4*d.* referred to above, the purchaser at 30 of a £10 annuity, to commence at 60, would have

to pay £40 9s. 2d., and so in proportion. No annuity can exceed £50 per annum, or £4 3s. 4d. per month, except in the case of husband and wife, who may each be insured or purchase an annuity to the full amount allowed by the act.

After many fruitless attempts at legislation, an act (38 and 39 Vict. c. 60) was passed in 1875 to consolidate and amend the law relating to friendly societies. It deals with (1) all societies which provide for the relief of members or their relatives during sickness, infirmity, old age, or widowhood, or for orphans during minority; for small insurances on occasions of birth or death; for maintenance of members in distress, or when on travel in search of employment; for endowment of members or their nominees; and for insurance of tools or other working implements up to fifteen pound value. It is, however, provided that no society assuring annuities exceeding £50 per annum, or gross sums exceeding £200, shall be registered under the act, and that no sum exceeding £6 altogether shall be insured or paid on the death of a child under five years of age, and no sum exceeding £10 on the death of a child under ten years. It also deals with (2) cattle insurance societies, to whatever amount the insurances extend; (3) benevolent societies; (4) working-men's clubs; and (5), with certain limitations, specially authorized societies, for any purpose to which, in the judgment of the treasury, the act ought to extend. The act establishes a central office, with chief registrar and assistants, whose functions are to examine and certify rules, to prepare and circulate model forms of accounts, balance sheets and valuations; to collect and publish statistics of life and sickness, and other matters applicable to the business of friendly societies; and to construct and publish tables for the payment of sums of money at death, in sickness, old age, or other calculable contingencies. These tables, though intended for the guidance of societies, are not to be compulsory, but no society granting annuities can be registered under the act unless its tables are certified by an actuary approved by the treasury. All societies are to have registered officers, must appoint trustees, provide for efficient audit, and furnish classified returns of receipt and expenditure annually to the register. Friendly societies must also, once in every five years, make a return of the sickness and mortality of their members, and prepare a valuation, either by their own valuer or the registrar, of their assets and liabilities. The nominee of a member may be paid a sum not exceeding £50 on the death of the nominator, and societies are empowered to pay a like amount to the representatives of a deceased member, without letters of administration. Minors may be members, but they are not permitted to hold office. Societies may invest moneys in the post-office or other savings-banks, in the public funds, with the commissioners for the reduction of the national debt, in the purchase of lands or the erection of buildings for their own use, and in other securities directed by their rules. Under certain circumstances, and with specified guarantees, loans may be made to members on personal security. Officers are to provide sureties and render accounts, and provision is made for arbitration or summary legal jurisdiction in cases of dispute, as also for amalgamation or dissolution. The act bears abundant evidence of the care bestowed upon it in its elaborate arrangements for registration, and other precautions for the safety and success of the societies to which it relates.

FRIENDS, SOCIETY OF, the proper designation of a sect of Christians, better known as Quakers. Their founder was George Fox (q.v. for the origin of the name Quakers), born at Drayton, in Leicestershire, in 1624, who at first followed the occupation of a shoemaker, but afterwards devoted himself to the propagation of what he regarded as a more spiritual form of Christianity than prevailed in his day. In spite of severe and cruel persecutions, the society of Friends succeeded in establishing themselves both in England and America. They have, indeed, never been numerically powerful (having at no time exceeded 200,000 members); but the purity of life which from the beginning has so honorably distinguished them as a class, has unquestionably exercised a salutary influence on the public at large; while in respect to certain great questions affecting the interests of mankind, such as *war* and *slavery*, they have, beyond all doubt, originated opinions and tendencies which, whether sound or erroneous, are no longer confined to themselves, but have widely leavened the mind of Christendom. For an account of the more eminent representatives of the Friends, see the biographies of BARCLAY, FOX, PENN, etc. We confine ourselves here to a brief notice of their doctrine, practice, and discipline, as it is laid down in their own publications.

1. *Doctrine.*—It is perhaps more in the *spirit* than in the *letter* of their faith that the society of Friends differ from other orthodox Christians. They themselves assert their belief in the great fundamental facts of Christianity, and even in the substantial identity of most of the doctrinal opinions which they hold with those of other evangelical denominations. The epistle addressed by George Fox and other Friends to the governor of Barbadoes, in 1678, contains a confession of faith not differing materially from the so-called Apostles' Creed, except that it is more copiously worded, and dwells with great diffuseness on the internal work of Christ. The Declaration of Christian Doctrine given forth on behalf of the society in 1693, expresses a belief in what is usually termed the Trinity, in the atonement made by Christ for sin, in the resurrection from the dead, and in the doctrine of a final and eternal judgment; and the declaratory minute of the yearly meeting in 1829 asserts the inspiration and divine authority of the Old and New Testament, the depravity of human nature consequent on

the fall of Adam, and other characteristic doctrines of Christian orthodoxy, adding: "Our religious society, from its earliest establishment to the present day, has received these most important doctrines of Holy Scripture in their plain and obvious acceptation." It is nevertheless certain that uniformity of theological opinion cannot be predicated of the Friends, any more than of other bodies of Christians. As early as 1668, William Penn and George Whitehead held a public discussion with a clergyman of the English church, named Vincent, in which they maintained that the doctrine of a tri-personal God, as held by that church, was not found in the Scriptures, though in what form they accepted the doctrine themselves does not appear; and some time later, Penn published a work himself, entitled the *Sandy Foundation Shaken*, in which, among other things, he endeavored to show that the doctrines of vicarious atonement and of imputed righteousness did not rest on any scriptural foundation. But in general, the society of Friends, in the expression of their belief, have avoided the technical phraseology of other Christian churches, restricting themselves with commendable modesty to the words of Scripture itself, as far as that is possible, and avoiding, in particular, the knotty points of Calvinistic divinity (see Barclay's *Catechism and Confession of Faith*, published in 1673, where the answers to the questions—to avoid theological dogmatism—are taken from the Bible itself). This habit of allowing to each individual the full freedom of the Scriptures, has, of course, rendered it all the more difficult to ascertain to what extent individual minds, among the society, may have differed in their mode of apprehending and dogmatically explaining the facts of Christianity. Their principal distinguishing doctrine is that of the "light of Christ in man," on which many of their outward peculiarities, as a religious body, are grounded. The doctrine of the internal light is founded on the view of Christ given by St. John, who, in the first chapter of his gospel, describes Christ—the Eternal Logos—as the "life" and "light of men," "the true light," "the light that lighteth every man that cometh into the world," etc. Barclay taught that even the heathen were illumined by this light, though they might not know—as, indeed, those who lived before Christ *could* not know—the historical Jesus in whom Christians believe. In their case, Christ was the light shining in darkness, though the darkness comprehended it not. The existence of "natural virtue" (as orthodox theologians term it) among the heathen was denied by Barclay, who regarded all such virtue as Christian in its essence, and as proceeding from the light of Christ shining through the darkness of pagan superstition. These opinions would seem to be somewhat freer than those expressed in the general epistle of the society published in 1836, wherein they refuse to acknowledge "any principle of spiritual light, life, or holiness inherent by nature in the mind of man," and again assert, that they "believe in no principle whatsoever of spiritual light, life, or holiness, except the influence of the Holy Spirit of God bestowed on mankind in various measures and degrees through Jesus Christ our Lord;" but, on the other hand, in a little treatise published by the society in 1861, it is affirmed that "the Holy Spirit has always been afforded in various measures to mankind;" while stress is also laid on the statement of St. Paul, that "the grace of God (understood by Friends to signify the 'operation of the Divine Spirit') that bringeth salvation, *hath appeared to all men*;" while another exponent of their views, Mr. T. Evans of Philadelphia (see *Cyclopædia of Religious Denominations*, Lond., Griffin & Co., 1853), states that "God hath granted to all men, of whatsoever nation or country, a day or time of visitation, during which it is possible for them to partake of the benefits of Christ's death, and be saved. For this end, he hath communicated to every man a measure of the light of his own Son, a measure of grace or the Holy Spirit, by which he invites, calls, exhorts, and strives with every man, in order to save him; which light or grace, as it is received, and not resisted, works the salvation of all, even of those who are ignorant of Adam's fall, and of the death and sufferings of Christ; both by bringing them to a sense of their own misery, and to be sharers in the sufferings of Christ inwardly; and by making them partakers of his resurrection, in becoming holy, pure, and righteous, and recovered out of their sins." Hence it may be safely asserted that they hold a broader (or, as others would say, a more latitudinarian) view of the Spirit's working than any other Christian church or society. In America, about the year 1827, Elias Hicks, a Friend of very remarkable powers, created a schism in the society, by the promulgation of opinions denying the miraculous conception, divinity, and atonement of Christ, and also the authenticity and divine authority of the Holy Scriptures. About one half of the society in America adopted the views of Hicks, and are known as Hicksite Friends; their opinions, of course, are repudiated by the rest of the society, who may be described as Orthodox Friends. The Hicksite schism thoroughly alarmed the latter, both in England and America, and a movement was begun in favor of education, of a doctrinal belief more nearly allied to that of the so-called "Evangelical" party, and of a relaxation in the formality and discipline of the society. The leader of this movement was Joseph John Gurney, of Norwich. This new tendency, however, excited considerable opposition among some of the Friends in America; and the consequence was a division among the Orthodox Friends themselves, and the formation of a new sect, called "Wilburites," after the name of their founder, John Wilbur, who are noted for the strictness with which they maintain the traditions and peculiarities of the society. (See *Friendly Sketches in America*, by William Tallack. Lond., Bennett,

1862.) Some slight indications of theological differences have manifested themselves in England also.

2. *Practice.*—It is in the application of their leading doctrine of the "internal light" that the peculiarities of the Friends are most apparent. Believing that it is the Holy Spirit, or the indwelling Christ, that alone maketh wise unto salvation, illumining the mind with true and spiritual knowledge of the deep things of God, they do not consider "human learning" essential to a minister of the gospel, and look with distrust on the method adopted by other churches for obtaining such—viz., by formally training after a human fashion a body of youths chosen on no principle of inward fitness. They believe that the call to this work now, as of old, is "not of men, neither by man, but by Jesus Christ, and God the Father;" and that it is bestowed irrespectively of rank, talent, learning, or sex. Consequently, they have no theological halls, professors of divinity, or classes for "students." Further, as fitness for the ministry is held to be a free gift of God through the Holy Spirit, so, they argue, it ought to be freely bestowed, in support of which they adduce the precept of the Savior—"Freely ye have received, freely give;" hence those who minister among them are not paid for their labor of love, but, on the other hand, whenever such are engaged from home in the work of the gospel, they are, in the spirit of Christian love, freely entertained, and have all their wants supplied: in short, the Friends maintain the absolutely voluntary character of religious obligations, and that Christians should do all for love, and nothing for money. It also follows from their view of a call to the work of the ministry, that women may exhort as well as men, for the "spirit of Christ" may move them as powerfully as the other sex. The prophecy of Joel as applied by Peter is cited as authority for the preaching of women: "On my servants and on my handmaidens I will pour out in those days of my spirit, and they shall prophesy." They also adduce the New Testament examples of Tryphæna, Tryphosa, the beloved Persis, and other women who appear to have labored in the gospel. Their mode of conducting public worship likewise illustrates the entireness of their dependence on the "internal light." In other religious bodies, the minister has a set *form* of worship, through which he must go, whether he feels devoutly disposed or not. This seems objectionable to the Friends, who meet and remain in silence until they believe themselves moved to speak by the Holy Ghost. Their prayers and praises are, for the most part, silent and inward. They prefer to make melody in their hearts unto God, considering such to be more spiritual than the outward service of the voice.

The doctrine of the "internal light" has also led the Friends to reject the ordinances of baptism and the Lord's supper as these are observed by other Christians. They believe the Christian baptism to be a spiritual one, and not, like the Jewish and heathen baptisms, one with water; in support of which they quote, among other passages, the words of John the Baptist himself: "I baptize you with water, but there cometh one after me who shall baptize you with the Holy Ghost and with fire." Similarly do they regard the rite of the Eucharist: It is, say they, inward and spiritual, and consists not in any symbolic breaking of bread and drinking of wine, but in that daily communion with Christ through the Holy Spirit, and through the obedience of faith, by which the believer is nourished and strengthened. They believe that the last words of the dying Redeemer on the cross, "It is finished," announced the entire abolition of symbolic rites; that under the new spiritual dispensation then introduced, the necessity for such, as a means of arriving at truth, ceased, and that their place has been abundantly supplied by the Comforter, the Holy Ghost, whose office it now is to lead and guide men into all truth. The true Christian supper, according to them, is set forth in the Revelations—"Behold I stand at the door and knock: if any man hear my voice and open the door, I will come in unto him, and will sup with him and he with me." For the same reason—viz., that the teaching of the Spirit is inward and spiritual—the Friends ignore the religious observance of days and times, with the exception of the Sabbath, which some at least among them regard as of perpetual obligation.

The taking or administering of oaths is regarded by Friends as inconsistent with the command of Christ, "swear not at all," and with the exhortation of the apostle James —"Above all things, my brethren, swear not, neither by heaven, neither by the earth, neither by any other oath: but let your yea be yea; and your nay, nay; lest ye fall into condemnation." They have also refused to pay tithes for the maintenance of what they hold to be a hireling ministry, believing that Christ put an end to the priesthood and ceremonial usages instituted under the Mosaic dispensation, and that he substituted none in their place. In consequence, all consistent Friends have been regularly mulcted of plate, furniture, or other goods, to the value of the amount due. The recent conversion of tithe into *rent-charge*, however, has, in the opinion of many Friends, largely removed objections to the payment of this ecclesiastical demand. In regard to the civil magistracy, while they respect and honor it, as ordained of God, they are careful to warn the members of their society against thoughtlessly incurring its responsibilities, involving as it does the administration of oaths, the issuing of orders and warrants in reference to ecclesiastical demands, the calling out of an armed force in cases of civil commotion, and other duties inconsistent with the peaceful principles of the society. The Friends have likewise consistently protested against war in all its forms; and the

society has repeatedly advised its members against aiding and assisting in the conveyance of soldiers, their baggage, arms, ammunition, or military stores. They regard the profession of arms and fighting, not only as diametrically opposed to the general spirit of Christ, whose advent was sung by angels in these words: "Glory to God in the highest, and on earth peace, good-will toward men;" but as positively forbidden by such precepts as—"Love your enemies, bless them that curse you, do good to them that hate you, and pray for them which despitefully use you and persecute you;" also, "Resist not evil: but whosoever shall smite thee on thy right cheek, turn to him the other also;" and while they acknowledge that temporary calamities may result from adopting this principle of non-resistance, they have so strong a faith in its being essentially the dictate of divine love to the Christian heart, that they believe God, by his wise and omnipotent providence, could and will yet make it "mighty to the pulling down of the strongholds of iniquity." The world, they believe, will by and by confess that the peace-makers are most truly the children of God. The efforts of the society for the emancipation of the slaves are a part of modern British history. They may most certainly lay claim to having cultivated the moral sense of their fellow-countrymen in regard to this important question. As early as 1727, they commenced to "censure" the traffic in slaves, as a practice "neither commendable nor allowed," and gradually warmed in their opposition, until the whole nation felt the glow, and entered with enthusiasm on the work of abolition. In respect to what may be called minor points, the Friends are also very scrupulous; they object to "balls, gaming-places, horse-races, and playhouses, those nurseries of debauchery and wickedness, the burden and grief of the sober part of other societies as well as of our own." The printed epistle of the yearly meeting of 1854 contains a warning against indulging in music, especially what goes by the name of "sacred music," and denounces musical exhibitions, such as oratorios, as essentially a "profanation"—the tendency of these things being, it is alleged, "to withdraw the soul from that quiet, humble, and retired frame in which prayer and praise may be truly offered with the spirit and with the understanding also." They object, besides, to "the hurtful tendency of reading plays, romances, novels, and other pernicious books;" and the yearly meeting of 1764 "recommends to every member of our society to discourage and suppress the same." A similar recommendation was issued by the society in 1851 for the benefit of "younger Friends" in particular, who would appear to have been eating the forbidden fruit. The printed epistle of the yearly meeting of 1724 likewise "advises against imitating the vain custom of wearing or giving mourning, and all extravagant expenses about the interment of the dead," and this advice has been repeatedly renewed. A multitude of other minute peculiarities, which it would be tedious to note, distinguish the Friends from their fellow-Christians.

3. *Discipline.*—By the term discipline the Friends understand "all those arrangements and regulations which are instituted for the civil and religious benefit of a Christian church." The necessity for such discipline soon began to make itself felt, and the result was the institution of certain meetings or assemblies. These are four in number: the first, the *preparative* meetings; second, the *monthly* meetings; third, the *quarterly* meetings; and, fourth, the *yearly* meetings. The first are usually composed of the members in any given place, in which there are generally two or more Friends of each sex, whose duty is to act as overseers of the meeting, taking cognizance of births, marriages, burials, removals, etc., the conduct of members, etc., and reporting thereon to the monthly meetings, to whom the executive department of the discipline is chiefly confided. The monthly meetings decide in cases of violation of discipline, and have the power of cutting off or disowning all who by their improper conduct, false doctrines, or other gross errors, bring reproach on the society, although the accused have the right of appeal to the quarterly meetings, and from these again to the yearly, whose decisions are final. The monthly meetings are also empowered to approve and acknowledge ministers, as well as to appoint "serious, discreet, and judicious Friends, who are not ministers, tenderly to encourage and help young ministers, and advise others, as they, in the wisdom of God, see occasion." They also execute a variety of other important duties. The quarterly meetings are composed of several monthly meetings, and exercise a sort of general supervision over the latter, and from whom they receive reports, and to whom they give such advice and decisions as they think right. The yearly meeting consists of select or representative members of the quarterly meetings. Its function is to consider generally the entire condition of the society in all its aspects. It receives in writing answers to questions it has previously addressed to the subordinate meetings, deliberates upon them, and legislates accordingly. To it exclusively the legislative power belongs. Though thus constituted somewhat according to presbyterian order, yet any member of the society may attend and take part in the proceedings.

Women have also a special sphere of discipline allotted to them: they inspect and relieve the wants of the poor of their own sex, take cognizance of proposals for marriage, deal with female delinquents privately, and under certain restrictions may even do so officially, though in the "testimony of disownment" they have always the assistance of members of the other sex.

The society of Friends, in the multitude of its regulations, has not forgotten the poor; charity in its narrower, as well as in its broader sense, has always been a beautiful feature of its members. The care of the poor was one of the earliest evidences which

Christianity afforded to the Gentiles of the superiority and divine character of its principles; and it is honorable to the society that a similar provision for those united to them in religious fellowship appears to have been one of the earliest occasions of their meetings for discipline. Nevertheless, in accordance with their ruling principle, that all Christian duty should be left for its fulfillment to the spontaneity of Christian love, and not performed under compulsion of any kind, the provision for the poor is purely voluntary; yet their liberality is proverbial throughout Britain and America.

Their number at present amounts, it is believed, to about 120,000 of which more than 90,000 belong to the United States. See Fox's *Journal;* Sewel's *History of the Quakers* (1722); Gurney's *Observations on the Peculiarities of the Society of Friends* (1824); Neale's *History of the Puritans.*

FRIENDS OF GOD, a small body of religious reformers of the 14th c., who labored for the reformation of the church while continuing their adherence to it. Their principal leader was Nicholas of Bâle. Tauler, the great Dominican mystic, was one of this brotherhood. Sympathizing to some extent with the "Brethren of the Free Spirit," they nevertheless avoided the fanaticisms ascribed to that body.

FRIENDS, PROGRESSIVE, a society formed in Pennsylvania in 1853, the result of a division among the regular Friends on questions of progress and reform. The new organization embraced all who advocated the equality of the human family, and recognized that their faith in God called for more than the mere assertion of creeds, and necessitated lives of benevolence and charity. The friends did not insist upon similarity of theological opinions, but based their principles upon unity of spirit in the practical matters of every-day life, and their mutual admiration for the pure and holy. They were not advocates of any kind of discipline or restraint, but opposed all churches alike on principle, considering it imposture to claim that they were in such relation to the Deity as to speak by his authority. This sect flourished for a time, but is now almost forgotten.

FRIES, ELIAS, a distinguished Swedish botanist, was b. 15th Aug., 1794, in the district of Femsjö, and studied at Lund, where he became demonstrator in botany in 1828. In 1834, he was translated to the university of Upsala, as professor of practical economics, with which, after the death of prof. Wahlenberg, in 1851, the chair of botany was conjoined. F.'s researches embrace the entire field of botany, *phanerogamous* as well as *cryptogamous* plants, and he was the first to introduce into Sweden the morphological theory, the basis of which is to be found in his *Systema Orbis Vegetabilis* (Lund, 1825). His earliest important work was *Observationes Mycologicæ* (2 vols., Copen. 1815–18). This was followed by his *Systema Mycologicum* (3 vols., Greifsw. 1821–29; supplement, 1830), which was completed in his *Elenchus Fungorum* (2 vols., Greifsw. 1828), and later in his *Novæ Symbolæ Mycologicæ* (Upsala, 1851). For another department of cryptogamic botany, the lichens, F. did very great service by his *Lichenographia Europæa Reformata* (Lund and Greifsw. 1831). Among his monographs the *Symbolæ ad Historiam Hieraciorum* (Upsala, 1848) deserves special mention. He wrote a number of works on the *Flora* of Scandinavia, and his *Summa Vegetabilium Scandinaviæ* (Upsala, 1846, *et seq.*) is especially reckoned one of his best productions. His *Herbarium Normale* (Upsala, 1847), collected at great expense, and with incredible industry, contains dried specimens of all the rarest plants of Scandinavia. F. wrote at various times a multitude of small dissertations on his favorite subjects. In 1851, he was appointed director of the botanical museum and garden attached to the university of Upsala, and in 1853, rector of the university. F., who was a member of the Swedish academy, retired from work in 1859, and died 8th Feb., 1878.

FRIES, JAKOB, FRIEDRICH, the founder of a philosophic school in Germany, was b. at Barby, in Prussian Saxony, 23d Aug., 1773, studied at Leipsic and Jena, and in 1805 went to Heidelberg, as professor of philosophy and mathematics. In 1816, he accepted a call to the chair of speculative philosophy at Jena, but was deprived of his professorship, on account of his participation in certain democratic disturbances of 1819. In 1824, however, he was appointed to the chair of physics and mathematics, which he occupied till his death, 10th Aug., 1843. F.'s writings are very numerous. Some of the more important are his *System der Philosophie als evidente Wissenschaft* (Leip., 1804); *Neue oder anthropologische Kritik der Vernunft* (3 vols., Heidelb., 1807; 2d ed., 1828–31); *System der Logik* (Heidelb., 1811; 3d ed., 1837); *Handbuch der physischen Anthropologie* (2 vols., Jena, 1820–21; 2d ed., 1837–39); *Die Lehren der Liebe, des Glaubens, und der Hoffnung* (Heidelb., 1823); and *Geschichte der Philosophie* (2 vols., Halle, 1837–40). In his philosophy, F. followed the method of Kant, but believing that method incomplete, he sought to supplement by an analytical nature-doctrine (*analytischen naturlehre*) of the human soul, which he designated philosphic anthropology. His *Glaubenslehre*, or doctrine of faith, by which he hoped to repair the ravages which the critical philosophy had made upon the certainty of our knowledge, resembles, in some respects, Jacobi's doctrine of the intuition of the pure reason. De Wette adopted it as the basis of his religious philosophy. Some of his disciples, Apelt, Schleiden, Schlömilch, Friedrich Francke, and Schmidt, published at Leipsic in 1848–49 several philosophic papers, entitled *Abhandlungen der Fries'schen Schule.*

FRIES'LAND, or VRIESLAND (ancient *Frisia*), one of the most northern and wealthy provinces of the Netherlands, lies between 52° 40' to 53° 30' n. lat. and 5° 30' to 6° 20' e. long., and is bounded, n. by the German ocean, w. and s.w. by the Zuiderzee. Jan. 1, 1875, pop. 311,246. In 1874, there were 10,658 births, 3,041 deaths, and 2,591 marriages. A large import and export trade is carried on, especially with England. In 1874, the ships which cleared in numbered 1165, of which 291 were English and 637 Dutch; 1273 cleared out, of which 302 were English and 714 Dutch. The exports to England included 4,915 tons of potatoes, 2,242 tons of oats, 266,041 cwt. of butter, and 40,766 cwt. of cheese.

The land is flat, and in some parts below the level of the sea, and is intersected by canals and streams. Lakes and marshes are numerous. The dikes, sluices, and canals are under the care of a special board, and are kept up at the local expense. The inland waters abound with fish. Rich pastures, well suited for the rearing of horses, cattle, sheep, and pigs, cover a third part of the surface. Large quantities of peat are made. The land products are chiefly wheat, rye, barley, oats, buckwheat, beans, pease, potatoes, colza, flax, etc. F. is well supplied with schools and charitable institutions. A sixth part of the population is at school. The capital is Leeuwarden (q.v.). Schiermonnikoog and Ameland carry on extensive fishing for cod, haddock, sole, turbot, etc.

East F., in 53° 8' to 53° 40' n. lat., and 6° 50' to 8° e. long., has an area of 1144 sq.m., and a pop. amounting, in 1871, to 195,394. It now forms the Hanoverian district of Aurich; chief towns, Emden and Aurich. It is bounded n. by the German ocean, w. by the Netherlands, s. by Aremberg, and e. by Oldenburg. Like Netherlands Friesland, it is low and flat, requiring the protection of dikes and sluices. Fishing and agriculture constitute the chief employment of the inhabitants, who are the descendants of the ancient Frisians. This province has frequently changed owners since 1744, when the family of Zirksena, in whose possession it had been for 300 years, became extinct. It was first ceded to Prussia, next incorporated by Napoleon with Holland and France; in 1814 it was restored to Prussia; in 1815 it was ceded to Hanover, along with which it again forms part of Prussia.

FRIEZE, in classical architecture, the central portion of the entablature (q.v.). It is also called (by Vitruvius) the Zophorus (life-bearing), from its being frequently ornamented with sculpture. From the same cause the term frieze is sometimes applied to any enriched horizontal band.

FRIGATE (probably connected with the Gothic *fargod*, a row-galley, and also with the Latin *aphractus*, an undecked galley), formerly a long narrow vessel propelled by oars and sails, used in the Mediterranean on occasions when speed was requisite. The name then came to be applied to men-of-war, of a class smaller than line-of-battle ships, and carrying from 20 to 50 guns, which were employed in the great wars of the 18th and early part of the 19th centuries as scouts and cruisers. The frigate was usually swift, easily managed, and capable of bearing well up to the wind. She became, therefore, the favorite ship in war-time, and bore off a large proportion of the prize-money. Frigates also served to obtain information as to the movements of hostile fleets, and to guide the sailing of their own; but it was unusual for them to join in the line of battle, their exploits ordinarily occurring in engagements with single ships of their own class. One of Nelson's commonest complaints was that he had not a larger number of swift frigates to intercept the enemy's cruisers; it having then been notorious that the French built faster and finer craft than those our dockyards could turn out, although it must be added that most of these rapid frigates had changed their flag before the war closed.

With steam, and the growth of the fleet in later times, frigates were developed more than any other men-of-war, and many of the largest ships in the navy belonged to this class, such as the *Diadem*, *Mersey*, *Orlando*, and the iron-plated *Warrior*, of 6,000 tons, three times the burden of any ship of the line in Nelson's fleet. Now, however, these are all ships of the past, incapable of contending with the turreted monsters which carry modern artillery.

FRIGATE BIRD, or MAN-OF-WAR BIRD, *Tachypetes aquilus*, or *Fregata aquilus*, a bird of the pelican family (*pelecanidæ*), the only well-ascertained species of its genus, which is allied to the cormorants. It is a large bird with black plumage, sometimes measuring 10 ft.—some say even 14 ft.—from tip to tip of its extended wings. It is a bird of very powerful and rapid flight, and there seems to be good reason for believing that it can remain on wing for days together. It inhabits the intertropical coasts, both of the Atlantic and Pacific oceans, often flying out far to sea, but returning. Its aërial evolutions are extremely graceful, and it soars to a great elevation. It is said never to dive for its prey, but to seize fishes only when they appear at the surface or above it. Flying-fishes constitute no small part of its food.

FRINGE OF THE GARMENT, an appendage worn by the Israelites on the edges and especially at the corners of their robes. It was originally enjoined on them by Moses, in accordance with divine direction, as a memento of God's commandments, which they were required continually to obey: Num. xv. 38–41. Originally this fringed or tasseled garment was the large outer one; but after the Jews were scattered abroad in other lands, and persecuted therein, wishing to conceal rather than display their nationality, they wore their fringes on a smaller inner robe. This is often called simply "the

fringes," and is worn by every orthodox Jew. Many of them wear also a fringed outward garment during their attendance on morning prayer. As the wearing of this fringe was an external act of obedience, easily performed, the Jews gradually attached more and more importance to it, and, forgetting that it was simply a reminder of duty, they at length regarded it as, in itself, the one great duty which included all others. In the Talmud one rabbi asks another, "Which commandment has your father admonished you to observe more than any other?" and the answer is: "The law of the fringes." Some of the rabbins say that "this law is as important as all the other laws put together;" that "whoso diligently keeps it is made worthy, and shall see the face of the majesty of God;" and that "when a man, clothed with the fringe, goes out to the door of his habitation, he is safe. God rejoiceth, the angel of death departeth, and the man shall be delivered from all hurt." Knowledge of the inordinate importance so generally ascribed to the mere appendage of a dress illustrates clearly the force of the Savior's judgment concerning the Pharisees, "All their works they do to be seen of men: they make broad their phylacteries and enlarge the fringes of their garments." It explains also the fact, that, in the opinion of the people, the hem (properly fringe) of Christ's garment represented the fullness of the power which, they believed, dwelt within him; so that a woman in the throng around him secretly touched the fringe of his garment, and many other persons begged the privilege of touching it, as being all that they needed to do in order to be healed.

FRINGES. In optics, those colored bands of diffraction (q.v.) which appear when a beam of light passes the clean edge of a screen, or is transmitted through a narrow slit or hole, are called fringes.

FRINGE TREE, *Chionanthus*, a genus of plants of the natural order *oleaceæ*, consisting of small trees or large shrubs, natives of America, the West Indies, Ceylon, and New Holland. The common F. T. or SNOWFLOWER (*C. Virginica*) is found in the United States from lat. 39° to the gulf of Mexico. It sometimes attains the height of 20 or 30 ft., but is rarely more than 8 or 10; has opposite oval leaves 6 or 7 in. long, and very numerous snow-white flowers in panicled racemes. The limb of the corolla is divided into four long linear segments, whence the name fringe tree. The fruit is an oval drupe. The tree is frequently cultivated as an ornamental plant.

FRINGILLIDÆ, a family of birds of the order *insessores*, tribe *conirostres*, having a conical or nearly conical bill, sometimes short and thick, sometimes comparatively slender and elongated, sometimes convex above, below, or at the sides, the commissure—line of junction of the mandibles—straight. The neck is short, and neither the legs nor the wings are long. The F. are all small birds; they feed chiefly on seeds—to some extent also on insects. The family is an extremely numerous one, and distributed over all parts of the world; represented in Britain by finches, linnets, sparrows, grosbeaks, crosbills, etc., and including also weaver-birds, bobolinks, cardinal-birds, whidaws, tanagers, etc. Some naturalists extend its limits so as to include in it other groups, as buntings, larks, etc., often regarded as forming distinct families.

FRIO, a co. in s. Texas, intersected by the Frio river, 1050 sq.m.; pop. '70, 309—15 colored. It is devoted chiefly to cattle-raising. Co. seat, Frio Town.

FRISCHES HAFF ("Fresh-water Bay"), a large lagoon on the coast of Prussia, s.e. of the gulf of Dantzic. It is rather less than 60 m. in length from n.e. to s.w., with a breadth which varies in different parts from 4 to 12 m., and an area of 318 sq. miles. It was once entirely walled off from the Baltic by the Frische Nehrung, a narrow spit of land extending for about 40 m. along its northern shore. In 1510, however, the waters of the F. H. broke over the Frische Nehrung, and formed the passage called the "Gatt," which unites this shore-lake with the Baltic. The Gatt is only from 10 to 15 ft. in depth. All large vessels load and unload at Pillau, which is situated at the mouth of the Gatt, on the shore of the gulf of Dantzic. Cargoes are conveyed to and from the ports on the F. H. by means of lighters. The Pregel, Frisching, Passarge, and two arms of the Vistula, fall into this lagoon.

FRISI, PAOLO, 1728–87; an Italian monk, professor of morals and metaphysics at Padua; in 1756, professor of mathematics in Pisa; and in 1764, mathematical professor at the university of Milan. He excelled as a mathematician, but his very positive character involved him in continual disputes. His works include a *Disquisitio Mathematica*, upon the physical cause of the earth's figure and motion; *De Atmosphaera Cœlestium Corporum; De Inæqualitate motus Planetarum; Del Modo di Regulare i Fiumi e i Torrenti;* and others.

FRISIANS. The Frisians (Lat. *Frisii*), an ancient Teutonic race, dwelt in the n.w. of Germany. The origin of the name is lost in antiquity, though traditions, collected and written in *Thet oera Linda Bok*, in the 13th c., say that the F. came out of India, and that Frya, the mother of the race, was white as snow. The F. are mentioned by Tacitus and Pliny, and occupied the country between the middle arm of the Rhine, which fell into the sea at Katwyk, to the Ems or the Weser. Along with the Batavi, the Bructeri, and the Chauci, the F. became subject to Rome under Drusus, and for a time remained faithful; but, in 28 A.D., these German tribes were driven to hostilities by the oppression of the Romans, and although partially subdued, they again rebelled,

70 A.D., under Claudius Civilis, a Batavian, who made a bold but unsuccessful attempt to overthrow the Roman power in German Gaul. When at a later period the Batavi were absorbed by the Franks, and with them moved southwards, the F. took possession of the abandoned districts, and occupied the country from the islands of the Scheldt to the Ems or Weser, so that the Netherlands, except some French and Saxon colonies, were peculiarly Frisian. These formed two branches, the one dwelling w. of the Zuiderzee, and the other e. of it. The Frisii of the s.w. were brought under the Franks by Pepin d'Heristal, who defeated them (689), and compelled them to embrace Christianity. The eastern branch (785) was subdued by Charlem . .e, who sent Christian teachers to preach the gospel to them, and who (802) defined their rights by the *Lex Frisionum*.

Later, the districts now called Friesland were reduced to their present limited boundaries by the formation of the hereditary countships of Holland, Zealand, Gueldres cum Zutphen, and the bishopric of Utrecht cum Yssel. Friesland was independent, and ruled by potentates chosen by the nation and endowed with limited powers, from 802 to 1498. The counts of Holland coveted the sovereignty of Friesland, and internal discord at length gave the emperor of Germany a pretext for placing duke Albert of Saxony (1498) as hereditary potentate. His son resigned the right, for a sum of money, to Charles V., who became lord of Friesland as of the rest of the Netherlands. After the revolution in the 16th c., the F. had a stadtholder of the house of Nassau-Dietz. Several of these fell in the contest for freedom. Count John William Friso became prince of Orange on the death of William III. His son, William Karel Hendrik Friso, became stadtholder of the seven united districts. The F. are brave, attached to their manners and customs, upright, open-hearted, and intelligent. Their language is closely allied to the old Anglo-Saxon. The favorite poet of the peasantry is Gysbert Japiks. There is a set of laws for the F., composed about 1200, and a complete collection of the laws still extant was published by Richthofen (*Fries Rechtsquellen*, Gött. 1840). A Frisian society of history, antiquity, and language, at Leeuwarden, has done much to promote a revival of Frisian literature. Among the historical writers may be mentioned Simon Abbes Gabbema, 1628–51; Petrus Wierdsma, 1729–1811; Foeke Sjoerds, 1713–70, etc. Since the 15th c., the Frisian language has gradually given place to the Dutch. It is only used by the peasantry, and not in the schools or churches. Dutch is generally spoken in the towns. Efforts have been made to revive the Frisian by publishing the best specimens of the literature, annuals, etc. Among these are the poetical works of Gysbert Japiks, with a Friesch-Dutch dictionary of the words, and *Thet oera Linda Bok*, edited and translated by Dr. Ottema, the authenticity of which, like Ossian's poems, has been disputed. The best Frisian dictionaries are the *Friesch-Latin-Nederlandsch Woordenbook* (1874), and Richthofen's *Altfriesisches Wörterbuch* (1840).

FRISIANS (*ante*). The Frisian language belongs to the Low German branch of the Teutonic, and presents special interest to the English philologist as the nearest of all extant forms to the Saxon basis of his own tongue. It is still spoken in the country districts of the present province of West Friesland; in a much more Germanized condition it still exists in Saterland, in East Friesland; in strangely differentiated dialects it holds its place in many of the islands along the coast; and, in spite of the encroachments of Low German on the one hand, and Danish on the other, it survives in the country between Husum and Tondern. Among its peculiarities may be mentioned the dropping of the final *n*, which is such a favorite termination in German (thus even *ma* for *man*, as in Halbertsma, the proper name); the use of *sk* for the German *sch* and the English *sh*, and of *t* for the German *k;* and, still more remarkable, the modification of *k* and *g* to *ts* when these letters precede *e* or *i*, as in *tserke* for *kerke*, *i.e.* kirk, church. The explanation of this last peculiarity may perhaps be found in the contact of the Frisian with Slavonic languages, in which the modification is sufficiently common. A brief sketch of Frisian grammar was published with the poems of Gysbert Japicx; but the first separate treatment of the older forms of the language was by Rask, whose *Frisisk Sproglære* brought him into controversy with Grimm, who, in his *Deutschen Grammatik*, devoted some attention to the same subject. Moritz Heyne has also given a good treatment of Frisian in his *Kurze Laut-und Flexionslehre der Allegermanischen Sprachstamme*. Richthofen's *Altfriesisches Worterbuch* practically supplanted the older work of Wiarda, and its position has not been affected by the publication of Haan Hattema's *Idioticon Frisicum*. The *Ostfriesisches Worterbuch*, by Sturenburg, is a dictionary, not of the Frisian, but of the Low German spoken in East Friesland, which has incorporated comparatively few Frisian words.

For the older forms of the language the sources are scanty; no great literary monument like that of the *Heliand* or the *Nibelungenlied* has been preserved; and the investigator has mainly to depend on the various legal codes or collections which were formed in the course of the 14th and 15th centuries, and have been published by Richthofen, *Friesische Rechtsquellen*. The great *Lex Frisionum* is composed in Latin, and contains only a few Frisian terms, of comparatively small linguistic importance. The date of its recension is also a matter of conjecture, as there is no contemporary evidence either internal or external. By the older investigators it was assigned a high antiquity; but the more modern are for the most part of the opinion that it is not earlier than the reign of

Charlemagne. Haan, Hettema, in his *Oude Friesche Wetten*, gives 802–4 as the probable date; while Richthofen thinks there are three portions: the first composed for use in Middle Frisia in the reign of Charles Martel or of Pippin; another for use in all Frisia, composed after Charlemagne's conquest in 785; and a third or supplementary and emendatory portion, composed in 802. The first edition of the *Lex Frisionum* was published by B. J. Herold in his *Originum ac Germanicarum Antiquitatum Libri*, but he gives no indication of the source of the manuscripts which he employed. Since his day there have been no fewer than 13 editions. Though it has been supposed that Lindenbrog and Siccama may have had access to some manuscript authority in addition to Herold's recension, there is no proof that such was the case; and the text still remains to all intents in the same state as when Herold left it. Some investigators have, owing to this absence of original evidence, even cast doubts on the authenticity of the code, but a comparison of the laws with undoubtedly genuine Frisian remains authorizes its acceptance. In West Frisia the native language holds much the same relation to Dutch as the Scottish language holds to English in Scotland; it has no legal or educational position, but it preserves among the peasantry a considerable vitality, and is even cultivated in a literary way by a small patriotic school. The chief place among West Frisian authors is due to Gysbert or Gilbert Japicx, rector at Bolsward, whose *Freische Rijmlerye* was published in 1668, and has since been frequently reprinted, with a glossary by Epkema. The volume contains secular, and especially humorous, poems, fifty of the psalms of David, and other religious pieces, a number of letters, one or two prose essays, and fragments of the *Customs* of Leeuwarden. There is one book which, more than any other, has attracted the attention of other than Frisian scholars. If the *Oera Linda* book, as it is called, could be accepted as genuine, it would be, after Homer and Hesiod, the oldest document of European origin; but unfortunately it must be recognized as nothing more than a brilliant forgery. The first part of the manuscript, the book of the followers of Adele, professes to have been copied in 1256 from an ancient original, and gives an account of Neptune, Minerva, Minos, and other personages of classical antiquity, which would make them out to be of Frisian origin. According to J. Beckering Vinckers, the real author is Cornelis Over de Linden, a ship-carpenter in the royal docks at Den Helder, who was born in 1811, and died in 1873, and who appears to have forged the document for the purpose of giving importance to his invectives against the church, and of conferring dignity on his family, which is traced by the book back for about two thousand years. [Condensed from *Encyc. Brit.* 9th ed.]

FRIT (*oscinis frit*, or *chlorops frit*), an insect of the same family with the house-fly; an active greenish-black fly of the size of a large flea, which does great injury to barley crops in some parts of the n. of Europe. It lays its eggs in the flowers, and its larvæ live on the young grains. Linnæus affirms that a tenth part of the barley in Sweden and Lapland is annually destroyed by it. It is not known in Britain, but is nearly allied to the insects called corn-fly and wheat-fly.

FRITH, or FIRTH (Lat. *fretum*, Gr. *porthmos;* from the same root as ferry, q.v.), an arm or channel of the sea that is passed or crossed; the opening of a river into the sea.

FRITH, WILLIAM POWELL, R.A., an eminent English artist, the son of an innkeeper at Ripon, Yorkshire, was b. in that town in 1819. In 1840, he first exhibited, at the royal academy, London, a scene from Shakespeare's *Twelfth Night*, "Malvolio before the Countess Olivia," which at once attracted attention, as giving promise of future excellence. In 1841, his painting of the "Parting Interview of Leicester and his Countess Amy," from Scott's *Kenilworth*, evinced a marked improvement in his style and manner. Thenceforth he rose rapidly in public estimation, and his subsequent productions amply confirmed the high anticipations that had been formed of his skill and power. Among the paintings exhibited by him in successive years were the following: "My Wife would bid both stand up to see which was the Tallest," a scene from the *Vicar of Wakefield*, in 1842; "English Merry-making a Hundred Years ago," in 1847; "An Old Woman Accused of Witchcraft in the Time of James I.," in 1848; and "Coming of Age," in 1849; etc. F. was elected an associate of the academy in 1845, and a royal academician in 1853. In 1854, his "Life at the Seaside" was one of the leading features of the exhibition. "The Derby Day," exhibited in 1858, and "Claude Duval," in 1860, are two of his most successful pictures. For the "Railway Station" (1862) he is said to have received 8,700 guineas. In 1865, he painted the "Marriage of the Prince of Wales." The series called the "Road to Ruin" was produced in 1878. F. was elected an honorary member of the imperial academy of fine arts at Vienna in 1869; of the royal academy of Belgium in 1871; and of the royal academy of Sweden in 1873.

FRITH, or FRYTH, JOHN, 1503–33; b. in Kent; one of the pioneers of the reformation in England; educated at Eton and at Cambridge, where Gardiner, subsequently bishop of Winchester, was his tutor. Immediately after taking his degree, invited by Wolsey, he transferred his residence to the newly-founded college of St. Frideswide, or Cardinal college (now Christ's church), Oxford. Suspected of sympathy with the reformation, he was imprisoned for some months. At the instance of Wolsey he was released from confinement in 1526 or 1527, and fled to the continent, where he resided chiefly at the newly-founded Protestant university of Marburg, and was associated with Tyndal in literary labors. At Marburg he became acquainted with several scholars and reformers

of note, and particularly with Patrick Hamilton. His first publication in fact was a translation of Hamilton's *Places*, made shortly after the martyrdom of their author; and soon afterwards appeared, with other works from his hand, *A Pistle to the Christen Reader, by Richard Brightwall* (supposed to be by him); *An Antithesis wherein are compared togeder Christes Actes and our Holye Father the Pope*, dated "at Malborow in the lande of Hesse;" and *Disputacyon of Purgatorye*, a treatise in three books, respectively against Rastell, sir T. More, and Fisher (bishop of Rochester). In 1532, in July or Aug., he ventured back to England, apparently on some important business, to which he and Tyndal attached importance in connection with the prior of Reading. Warrants for his arrest were almost immediately issued at the instance of sir T. More, then lord chancellor. After evading pursuit for some weeks, he fell into the hands of the authorities, as he was on the point of making his escape to Flanders. The rigor of his imprisonment in the Tower was abated when sir T. Audley succeeded to the chancellorship, and it was understood that both Cromwell and Cranmer were disposed to leniency. But the treacherous circulation of a manuscript, *Lyttle Treatise* on the sacraments, which Frith had written for the information of a friend, with no view to publication, further excited the hostility of his enemies; and in a Lenten sermon preached against the "sacramentaries" before the king, special reference was made to some at that time in the Tower, "so bold as to write in defense of that heresy," and who seemed to be put there "rather for safeguard than for punishment." On this instigation, F. was tried, and found guilty of denial that the doctrines of purgatory and transubstantiation were necessary articles of faith. June 23, 1533, he was handed over to the secular arm, and was burnt at Smithfield, July 4. During his captivity he had been busy with his pen, writing a controversial work on the eucharist, and two tracts, entitled respectively *A Mirror or Glass to know thyself*, and *A Mirror or Looking-glass wherein you may behold the Sacrament of Baptism*. Apart from his extraordinary ability, his acquirements, his piety, his early and tragic death, Frith is an interesting and important figure in English ecclesiastical history, as the first to maintain that doctrine regarding the sacrament of Christ's body and blood which ultimately came to be incorporated in the English communion office. Twenty-three years after Frith's death as a martyr to the doctrine of that office, that "Christ's natural body and blood are in heaven, not here," Cranmer, who had been one of his judges, went to the stake for the same belief. Within three years more, it had become the publicly-professed faith of the English nation. [*Encyc. Brit.*, 9th ed.]

FRITHJOF'S SAGA, which was probably first written down at the end of the 13th or in the beginning of the 14th c., is an ancient Icelandic myth, which records the life and adventures of the hero Frithjof (properly *Fridhthjofr;* i.e., "peace-destroyer"), who loved the beautiful Ingeborg, the daughter of a petty king of Norway. After being rejected by the brothers of Ingeborg, and having committed various acts of revenge on his enemies, he comes to the court of the old king Hring, to whom Ingeborg has been married, and is received with kindness. At the death of her husband, Ingeborg is married to her lover, who acquires with her hand the dominions of Hring, over which he rules prosperously to the end of his days. Frithjof is supposed to have lived in the 8th c.; but some writers assign to him a much earlier period. This saga was included by Björner in his collection *Nordiska Kämpadater* (Stock. 1737); and by Rafn in his *Fornaldar Sögur Nordhrlanda* (Copen. 1829). Attention has of late years been more especially drawn to this ancient saga, which is, in fact, merely one of a number of similar mythical narratives, in consequence of the distinguished Swedish poet, bishop Tegner, having selected it for the ground-work of a poem (*Frithjof's Saga*), which was published in its complete form in 1825, and at once became the most popular poem that had ever appeared in Sweden, and raised its author to the height of his reputation. Tegner follows the saga so closely, that the merits or demerits of the plan of the story must be ascribed more to the original than to himself; but to foreigners the poem scarcely seems to present the excellences that have been attributed to it by Swedish critics. The diversity of meter employed in the 24 cantos, of which each differs wholly from the others, detracts from the completeness of the whole, and produces an inharmonious effect. The *Frithjof's Saga* of Tegner has been translated into several other languages; among the six or seven English translations, we may instance those by R. G. Latham (1838) and G. Stephens (1841).

FRITILLARY, *Fritillaria*, a genus of plants of the natural order *liliaceæ*, herbaceous, bulbous-rooted, with bell-shaped perianth of six distinct segments, each having a conspicuous honey-pore (nectary) at the base. About twenty species are known, natives of Europe and other temperate regions of the northern hemisphere. All of them have drooping flowers; some of them are beautiful. One species only is a native of Britain, the COMMON F. (*F. meleagris*), which is found in meadows and pastures in the e. and s. of England, flowering in April or May. The stem, about a foot high, bears several linear leaves, and in general only one flower, which is flesh-colored, and marked with many dark spots. Many varieties are in cultivation.—This genus includes the CROWN IMPERIAL (*F. imperialis*), a native of Persia and the n. of India, a well-known ornament of our gardens.

FRITILLARY, a name given to a number of species of butterfly, some of which are common in Britain, from the resemblance of the coloring of their wings to that of the

petals of the common fritillary. This resemblance appears only on the upper side of the wings, the under side being often remarkable for metallic brilliancy.

FRIU'LI (Ger. *Friaul;* anc. *Forum Julii*), formerly the name of a district in the extreme n.e. of Italy. It constituted one of the 36 duchies into which the Longobards divided the n. of Italy. Its first duke is said to have been Graeulf (568–588 A. D.), nephew of the Longobardian king Alboin. It shared in all the incessant vicissitudes of the Lombard states during the middle ages. From an early period, F. was divided into *Tyrolese* and *Venetian* F., the former of which came into the possession of the emperor Maximilian in 1500, while the latter remained attached to Venice till the peace of Campo-Formio (1797), when it was given to Austria. The inhabitants, called *Furlani*, are for the most part Italian, but make use of a peculiar dialect. The soil is fertile, and also rich in minerals and healing springs.

FRIVALDSZKY, EMRICH, a Hungarian naturalist, head-keeper of the national museum of Hungary, was b. in 1799, at Sátoraljaujhely, in the co. of Zemplén. In 1822, F. was admitted a member of the college of physicians at Pesth, and soon afterwards appointed assistant-keeper in the department of natural history. F.'s investigations lay in tracts hitherto little known to naturalists. His monogram of the parallel between the northern Carpathians and the Alpine chain of the lower Banat was presented to the Hungarian academy in 1846. The sketches from the natural history of the Olympus, of Asia Minor, etc., contain original views, and are distinguished for exactness. F.'s zeal for augmenting the natural treasures of the national museum, and for the promotion of natural science in general, were known far beyond the boundaries of his native country.

FRIVOLOUS AND VEXATIOUS. By 9 Geo. IV. c. 22, s. 15, it was enacted, that if the select committee of the house of commons, appointed to try a petition against an election, should be of opinion that any ground of objection stated against a voter was *frivolous* or *vexatious*, they should find the opposite party entitled to recover the full costs incurred by reason of such objection; and s. 40 provides, with reference to petitions in general, that the committee, at the time that they inform the house of their final determination on the petition, shall also report whether it did or did not appear to them to be frivolous or vexatious; and whether the opposition to it or the return was or was not vexatious or corrupt, in all which cases the parties frivolously petitioning or objecting are burdened with costs. The penalty of paying costs is likewise imposed by 5 and 6 Vict. c. 102, s. 15, on any one who shall bring forward a frivolous or vexatious charge of bribery. See ELECTION. Vexatious indictments for various crimes are prohibited by 22 and 23 Vict. c. 17, which provides that no indictment for the crimes therein mentioned shall be preferred without authorization from one or other of the public officers therein mentioned. The statute does not extend to Scotland. As to frivolous and vexatious actions at law, see 3 and 4 Vict. c. 24, by which a portion of 43 Eliz. c. 6, is repealed; 4 and 5 Vict. c. 28, which again repeals a portion of 3 and 4 Vict. c. 24.

FROBEN, or FROBE'NIUS, JOANNES, 1460–1537; a German scholar and printer, educated at the university of Bâle. He was the first German who brought the art of printing near perfection. He was on intimate terms of friendship with Erasmus, who not only had his own works printed by him, but superintended Frobenius's editions of St. Jerome, St. Cyprian, Tertullian, Hillary of Poictiers, and St. Ambrose. It was part of his plan to have printed also editions of the Greek fathers. He did not live to carry out this project, but it was very creditably executed by his son Jerome and his son-in-law. An extant letter of Erasmus, written in the year of Frobenius's death, gives an epitome of his life and an estimate of his character; and in it Erasmus mentions that his grief for the death of his friend was far more poignant than that which he felt for the loss of his own brother. The epistle concludes with an epitaph in Greek and Latin.

FROBISHER, Sir MARTIN, a distinguished naval adventurer of the Elizabethan period, the first Englishman who sought to discover a n.w. passage to China, was a native of Doncaster, but the year of his birth is unknown. For many years, he in vain labored to impress English merchants with an idea of the importance of a n.w passage; but at length, being patronized by some persons of rank and fortune, he succeeded in raising money enough to fit out two small vessels of 25 tons each, and a pinnace of 10 tons. With these he sailed from Deptford on June 8, 1576, the queen, who was then at Greenwich, bidding them God speed on their venturous way by "shaking her hand at them out of the window." Steering their course n., they, in lat. 61° n., sighted the southern part of Greenland, which F. took to be the Friesland of Zeno, on the 11th July, to the e. point of which F. gave the name of "Queen Elizabeth's Foreland;" and on the 28th, they sighted *Meta Incognita.* On the 11th of Aug., F. entered the strait which bears his name, and which forms one of the entrances from Davis' strait into Hudson's bay. After about a fortnight's exploration of the coasts and islands, F.—having lost, through the treachery of the natives, a boat and five men—returned to England. He brought with him some ore picked up on one of the islands he discovered, in which some gold was found. Visions of immense wealth to be

derived from further search in these northern lands floated before the eyes of the speculators of the time, who immediately fitted out another and better appointed expedition, giving the command to Frobisher. He sailed in May, 1577, but his discoveries, hampered as he was by the gold-seeking operations, which turned out comparatively trifling, did not extend further than the neighborhood of the strait he had before reached. A third expedition was sent out in the year following; but geographical science appears to have been but little benefited by it. F. afterwards served under Drake in the West Indies; and for his distinguished bravery in the fight with the Spanish armada, July 26, 1588, he received the honor of knighthood. He afterwards commanded a squadron sent out to ravage the Spanish coast. He died on Nov. 7, 1594, from the effects of a wound received while leading an attack by sea against Brest.

FROBISHER STRAIT, a passage between the w. side of Davis' strait and the n. side of Hudson's strait, is 140 m. long, with an average breadth of 20. It extends in lat. from 62° to 64° n., and in long. from 65° to 73° or 74° w. It is not of any practical value as a channel of communication; and, in fact, it has been very seldom visited by vessels bound either westward or eastward.

FROE'BEL, FRIEDRICH WILHELM AUGUST, 1782–1852; a German philosopher, philanthropist, and educational reformer. He was the son of a priest, and lost his mother while in infancy. An uncle gave him a home and sent him to school; but he was a strange child, and passed for a dunce; so while his half-brother was sent to the university, F. was apprenticed to a forester. In the grand Thuringian forest his study of nature, despite the absence of scientific instruction, gave him a profound insight into the laws of the universe, strengthened his inborn tendency to mysticism; and when at the age of 17 he left the forest, he seemed to have been possessed by the main ideas which influenced his after-life. He was too poor to study in the university, although he tried it for a few months, returning home with dark prospects. When he was 20 years old his father died, and he was left to take care of himself. For more than three years he tried one thing and another, satisfied with nothing, but always believed that he had some great work to do; and at last, while studying architecture in Frankfort, he became acquainted with the director of a model school who had caught some of the enthusiasm of Pestalozzi. He took a place in the school, and worked with success for two years. Then undertaking the education of three boys in one family, he took them to Yverdon, near Neufchatel, forming with them a part of the celebrated institution of Pestalozzi. Here, taking the results at which Pestalozzi had arrived through the necessity of his opinion, F. developed their principles by deduction from the nature of man. In 1811, he began study at Göttingen; but again was interrupted, this time by the king of Prussia's celebrated call "to my peple." Though not a Prussian, he enlisted and went through the campaign of 1813. While he did his duty as a soldier, he carried in his thoughts his future calling as an educator. After the peace of 1814, Froebel became curator of the museum of mineralogy in Berlin. Learning that his brother's widow in a village on the Ilm was in trouble, F. gave up his post and set out on foot to assist her. He spent his last groschen on the way for bread. He undertook the education of his orphan niece and nephews, and of the nephews sent by another brother, and with these children opened a school in the village of Keilhau, in Thuringia. Froebel, with his friends Langethal, Middendorf, and Barop, a relative of Middendorf's all married, and formed an educational community. The little school increased, though its founders were often in straits for money, and sometimes even for food. In his conferences with young Swiss teachers sent to him by the government on the occasion of his being in Lucerne, he found that the schools suffered from the state of the raw material brought into them. Until the school age was reached, the children were entirely neglected. His conception of harmonious development naturally led him to attach much importance to the earliest years, and his great work on the *Education of Man*, published in 1826, deals chiefly with the child up to the age of seven. At Burgdorf, where he had these young teachers for pupils, his thoughts were much occupied with the proper treatment of young children, and in scheming for them a graduated course of exercises, modeled on the games in which he observed them to be most interested. In his eagerness to carry out his own plans he became impatient of official restraints; so he returned to Keilhau and soon afterwards opened the first "kindergarten" or "garden of children," in the neighboring village of Blankenburg in 1837. In 1849, he attracted within the circle of his influence a woman of great intellectual power, the baroness von Marenholtz-Bülow, who, in her *Recollections of Friedrich Froebel*, has given us the only life-like portrait we possess. It seemed that those were to be Froebel's most peaceful days. He had become a widower; and now, marrying again, he began the education of young women for teachers. But trouble came upon him from an unexpected quarter. His nephew Karl had published books advocating theories widely different from those of F., and which were deemed socialistic. The distinction between the two men was overlooked, and in the reaction which soon set in after the year of revolutions, 1848, F. found himself suspected of socialism and irreligion; and in 1851 the "cultus-minister" Raumer issued an edict forbidding the establishment in Prussia of schools "after Friedrich and Karl Froebel's principles." This was a heavy blow to the old man, who had looked to the government of the "Cultus-staat" Prussia for support, but was met with denunciation. The charges brought

against F. were absurdly untrue. Whether from the worry of this new controversy, or from whatever cause, F. did not long survive the decree. His 70th birthday was celebrated with great rejoicings in May, 1852, but he died in the following month, and lies buried at Schweina, a village near his last abode, Marienthal.

"All education," says Froebel "not founded on religion is unproductive." This conviction followed naturally from his conception of the unity of all things, a unity due to the original Unity whence all proceed and in whom all "live, move, and have their being." "All has come forth from the divine, from God, and is through God alone conditioned. To this it is that all things owe their existence, to the divine working in them. The divine element that works in each thing is the true idea of the thing." "The destiny and calling of all things is to develop their true idea, and in so doing to reveal God in outward and through passing forms." "In the creation, in nature and the order of the material world, and in the progress of mankind, God has given us the true type of education." As the cultivator creates nothing in the trees and plants, so the educator creates nothing in the children—he merely superintends the development of inborn faculties. So far F. agrees with Pestalozzi; but in one respect he went beyond him, and has thus become, according to Michelet, the greatest of educational reformers. Pestalozzi had said that the faculties were developed by exercise, F. added that the function of education was to develop the faculties by arousing *voluntary activity*. Action proceeding from inner impulse was the one thing needful. And here Froebel, as usual, refers to God. "God's every thought is a work, a deed." As God is the Creator, so must man be a creator also. "He who will early learn to recognize the Creator must early exercise his own power of action with the consciousness that he is bringing about what is good, for the doing good is the link between the creature and the creator, and the conscious doing of it is the conscious connection, the true living union of the man with God, of the individual man as of the human race, and is therefore at once the starting-point and the eternal aim of all education." Again he says: "The starting point of all that appears, of all that exists, and therefore of all intellectual conception, is act, action. From the act, from action, must therefore start true human education, the developing education of man; in action, in acting, it must be rooted and must spring up. . . . Living, acting, conceiving—these must form a triple chord within every child of man, though the sound now of this string, now of that, may preponderate, and then again of two together." F. held with Rousseau that each age has a completeness of its own, and that the perfection of the latter stage can be attained only through the perfection of the earlier. Impressed with the immense importance of the first stage, F., like Pestalozzi, devoted himself to the instruction of mothers. But he would not, like Pestalozzi, leave the children entirely in the mother's hands. Petalozzi held that the child belonged to the family; Fichte, on the other hand, claimed it for society and the state. Froebel, whose mind delighted in harmonizing apparent contradictions, and who taught that "all progress lay through opposites to their reconciliation," maintained that the child belonged both to the family and to society and he would therefore have children spend some hours of the day in a common life and in well-organized employments. These assemblies of children he would not call schools, for the children in them ought not to be old enough for schooling. So he invented the name "kindergarten," garden of children, and called the superintendents "children's gardeners." He laid great stress on every child cultivating its own plot of ground, but this was not his reason for his choice of the name. It was rather that he thought of these institutions as inclosures in which young human plants are nurtured. In the kindergarten the children's employment should be play. But any occupation in which children delight is play to them; and Froebel invented a series of employments which, while they are in this sense play to the children, have nevertheless, as seen from the adult point of view, a distinct edutional object. [Condensed from *Encyc. Brit.* 9th ed.] See KINDERGARTEN, *ante*.

FROE'BEL, JULIUS, b. 1806; a German writer and politician, nephew of Friedrich. After studying at Rudolstadt, Keilhau, Stuttgart, Munich, Weimar, and Berlin, Julius was appointed to the chair of philosophy and natural history at Zurich. Subsequently, he officiated in the high school of that town as professor of mineralogy. Having become a naturalized citizen of Switzerland in 1826, he took part in politics, in the interest of the extreme radical party, and edited *Der Sweizerische Republikaner*. He established a publishing house at Zurich, and, devoting himself exclusively to this establishment, he relinquished his professorship in 1844, and issued several scientific works and many political pamphlets, which found many readers. Some of his works were suppressed by the government. Having returned to Germany, he was expelled from the Prussian territory, and took up his abode in Dresden until the revolution of 1848, when he became a popular leader of the democrats, and a member of the German parliament at Frankfort-on-the-Main. He accompanied Robert Blum to Vienna, and was arrested, but acquitted by the same court-martial which pronounced the sentence of death upon his unfortunate friend. After the dissolution of the parliament he came to the United States, lectured in New York on German politics, engaged in commercial pursuits there, went, in 1850, to Nicaragua, and afterwards engaged in one or two commercial expeditions to Santa Fé and Chihuahua. In 1855, he edited a journal at San Francisco; and in 1857,

after his return to Germany, he was expelled from Frankfort, and went to reside in London. In 1862, he was an editor in Vienna; and in 1873, was made German consul at Smyrna. Among his works, which include many on geography and politics, are: *System der Socialen Politik; Die Republikaner*, an historical drama in five acts; and *Aus Amerika, Erfahrungen, Reisen, und Studien*, translated into English, under the title of *Seven Years' Travel in Central America, Northern Mexico, and the Far West of the United States*

FROG, *Rana*, a genus of *batrachia*, having in the adult state four legs and no tail, no gills, four toes on each of the fore-feet, five on each of the hind-feet, the feet more or less webbed; the head flat, the muzzle rounded; the mouth very large, a row of small teeth in the upper jaw, and an interrupted transverse row on the middle of the palate. The young (tadpoles) breathe by means of gills; external gills forming little fringes at the sides of the neck when they are very young, which, however, in a few days disappear; the gills, which remain until the tadpoles undergo their final metamorphosis into frogs, being very numerous minute crests attached to four cartilaginous arches on each side of the neck, in a cavity to which the water enters from the mouth, and from which it is expelled by one or two small orifices. Tadpoles have no legs, and the body tapers into a tail, and thus has a fish-like form, very different from that of the mature F., the tail being furnished with a membranous border like a fin. The mouth of the tadpole is a horny beak, which falls off when it becomes a frog. When this metamorphosis takes place, the hind-legs grow first, and afterwards the fore-legs begin to appear, the tail being gradually absorbed. Tadpoles are capable of living in water only; but the mature F. visits the water only occasionally, although generally capable of remaining long immersed, and always preferring moist places. In respiration, frogs draw in air through the nostrils, by movements of the muscles of the throat, and expel it by contraction of those of the lower part of the abdomen. The thin smooth skin of frogs is also believed to be subservient to the aëration of the blood. The skeleton is destitute of ribs. The eye is large and very beautiful. The colors are often pleasing, and the general aspect agreeable, in some species very much so, forming a strong contrast to the repulsive appearance presented by toads, notwithstanding the close affinity between them both in structure and habits. The greater proportionate length and strength of the hind-legs enables frogs to leap to a distance wonderful for creatures of their size, instead of crawling as toads do, and their activity and liveliness complete the contrast. The males have on each side of the neck a delicate membrane, which becomes inflated with air when they croak. The power of voice in the females is much inferior. The croaking of numerous frogs in marshy places, or around ponds and ditches, often makes an amusing and curious concert; but the powers of voice possessed by the frogs of Britain are not to be compared with those of the great bull-frogs (q.v.) of North America; whilst the neighborhood of Rio Janeiro is enlivened as night comes on by the blacksmith F., which croaks so sonorously that the noise is like the clanging of a hammer on an anvil, the intermingled voices of some other kinds resembling the lowing of cattle at a distance; and in Peru, there is a F., of large dimensions, which has acquired the name of *trapichero*, or sugar-miller, because its voice has a grating sound like that produced by a sugar-mill. The confused blending of the voices of different species of frogs, in these countries, destroying the stillness of night, is one of the things most certain to arrest the attention of the stranger. In colder climates, frogs usually bury themselves in mud, and spend the winter in torpidity. In dry weather, they conceal themselves under shrubs and in tufts of herbage, from which rain quickly causes them to come forth, multitudes often appearing where not one was to be seen before. They feed chiefly on insects, slugs, etc. The beaks of tadpoles are adapted to the eating of leaves and other vegetable food, on which Cuvier says they entirely subsist; but the younger Buckland, in his *Curiosities of Natural History* (4th ed., Lond. 1859, pp. 2–4), in an amusing account of the habits of tadpoles, more correctly describes them as showing a great avidity for animal food, crowding round a dead kitten, and nibbling at the toes of little boys who wade in pools where they abound. The spawn of frogs is a gelatinous mass, in which the eggs are contained, and which swells greatly by imbibing moisture. Impregnation takes place after it is deposited, as with the spawn of fishes.

The only species of F. certainly known to be British is that called in France the RED F. (*R. temporaria*), which is abundant in most parts of England and Scotland, but is said not to be truly indigenous to Ireland, and to have been introduced into that island in 1696. Its generally reddish color, varied with black spots and patches, readily distinguishes it from the GREEN F. or EDIBLE F. (*R. esculenta*) of the s. of Europe—sometimes said also to have been found in Britain—which is olive green, with yellow stripes along the back, and generally larger than the red species. The s. of Europe produces a number of other species, and they are generally more numerous in warmer climates. A remarkable peculiarity is exhibited by some frogs of tropical countries in a hornlike prominence above each eye. These have been separated into a new genus (*ceratophris*). The Tree Frogs (q.v.), (*hyla*), the most beautiful and interesting of all, have the extremities of the toes enlarged into a sort of cushion, secreting a viscid humor. Several other genera have been separated from the Linnæan genus *rana*, but there is a strong family likeness among them all.

The use of frogs for food is generally regarded with disgust in Britain, but it is

very common in some of the southern countries of Europe, and they are regarded as particularly delicate. The species chiefly used as food in Europe is the GREEN F. (*rana esculenta*), already mentioned, which greatly abounds in ponds and slow streams in France, southern Germany, and Italy. It feeds chiefly on insects, after which it darts with great agility on the banks, and may often be seen swimming with its head above water, or basking in the sunshine. Frogs are there taken for the market by nets, and by a kind of rake. In Vienna, they are kept and fattened in preserves adapted to the purpose. In France, the hind-quarters alone are prepared for the table; in Germany, all the muscular parts. They are dressed in various ways, and with various sauces, of which a great part often consists of wine.—The GRUNTING F. (*R. grunniens*) of the West Indies, a very large species, 6 or 8 in. long, capable of leaping over a five-feet wall, is much used for food, its flesh being very white and delicate, and is often fattened for the table. It shows a considerable capacity for domestication, and readily becomes familiar.—A species of F. (*pyxicephalus adspersus* of Dr. Smith) is much used as food by the native tribes of s. Africa. Dr. Livingstone says the Bechuanas suppose it to fall from thunder clouds, because the pools suddenly filled with water after a thunder-shower become instantly alive with loud-croaking frogs, which have previously been hidden in holes at the roots of bushes. This species is nearly 6 in. long, and when cooked resembles chicken.

FROG-BIT. See HYDROCHARIDEÆ.

FROG-FISH, *Batrachus*, a genus of fishes of the family *lophiidæ*, to which also the angler (q.v.) or fishing-frog belongs. They are remarkable for excessive ugliness. The head is larger than the body; flattened, and spiny; the mouth is very large, with many teeth; the lips are often furnished with filaments; the pectoral fins are supported by a short stalk or wrist. The skin is naked in some species, scaly in others. The species are numerous and widely distributed, but none of them is British. They hide themselves in the sand to surprise their prey.

FROGGED, a term used in regard to uniforms, and applied to stripes or workings of braid or lace, as ornaments, mostly on the breast, on the plain cloth of which a coat is made.

FROG-SPAWN, the popular name of certain fresh-water algæ which make green and slimy masses on the surface of streams. The name is applied properly to the gelatinous mass inclosing the ova of frogs.

FROG-SPITTLE, a frothy substance appearing on weeds, grasses, etc., much resembling human spittle in general appearance. It contains grubs of insects of certain families of the *hemiptera*. The froth is generated by the sap of the plant.

FROISSART, JEAN, a French poet and historian, was b. at Valenciennes in the year 1337. Being destined for the church, he received a liberal education, but soon displayed a passion for poetry and the charms of knightly society. At the age of 20, he began to write a history of the wars of his time, and made several journeys to examine the theater of the events he was about to relate. The composition of this work, which forms the first part of his chronicles, occupied him about three years (1357–60). On its completion, he went over to England, where he was received with great favor by Philippa of Hainault, wife of Edward III. In 1362, she appointed him clerk of her chapel and secretary. Two years afterwards, he visited Scotland, where he became the guest of king David Bruce, and also of William earl of Douglas. Everywhere the gay, poetical, quick-witted, and shrewdly observant Frenchman was welcomed and honored. In 1366, he accompanied the black prince to Aquitaine and Bordeaux. He afterwards went with the duke of Clarence to Italy. F., along with Chaucer and Petrarch, was present at the marriage of this prince, at Milan, with the daughter of Galeazzo Visconti, and directed the festivities given by Amadeus VI., of Savoy, in honor of the duke. On the death of his protectress Philippa, F. gave up all connection with England, and, after many adventures, entered the service of Wenceslaus, duke of Brabant, as private secretary. The duke was himself a poet, and F. made a collection of his verses, to which he added some of his own, and entitled the whole *Meliador, or the Knight of the Golden Sun.* On the death of Wenceslaus, he entered the service of Guy, count of Blois, who encouraged him to continue his chronicles. He now took a journey to the court of Gaston Phœbus, count de Foix, that he might hear from the lips of the knights of Bearn and Gascony an account of their exploits. F. also made several other journeys, to collect information for his chronicles. In 1394, he obtained the canonry and treasurership of the collegiate church of Chimay; in the following year visited England, where he was courteously and generously entertained by king Richard II.; and on his return spent the remainder of his life in completing his great work. He died at Chimay in 1410. F.'s chronicles embrace the events occurring 1326–1400. They are valuable documents for illustrating the character and manners of his age. The pageantry of feudal times brightens his pages; the din of arms, the shouting of knights, and the marshaling of troops, is ever and anon heard; while "visions of fair women" rise before us as we read. The gorgeous feasts and spectacles in which F. so much delighted are set forth in copious details; and though F. is no philosopher, his shrewd observations and richly minute descriptions have helped others to philosophize. F.'s

chronicles first appeared at Paris about the end of the 15th c. under the title of *Chroniques de France, d'Angleterre, d'Ecosse, d'Espagne, de Bretagne, de Gascogne, Flandres et lieux d'alentour.* The best edition is that of Buchon (15 vols., Par. 1824–26). His poems have likewise been published by Buchon (Par. 1829). The beautiful MS. of the chronicles in the library at Breslau was executed in 1468, and was secured to the town in a separate article, when Breslau capitulated to the French in the year 1806. The chronicles have also been translated into Latin and several modern languages. England has two versions: one executed in 1523–25 by Bourchier lord Berners (reprinted in 1812); and the other in 1803–5 by Thomas Johnes (reprinted by Bohn in 1845). The latter is the more exact; but the former, according to sir Walter Scott, is the more artless and lively.

FROME, or FROME SELWOOD, a parliamentary and municipal borough, in the e. of Somersetshire, on the Frome, a branch of the Avon, 12 m. s.s.e. of Bath. The surrounding country is very picturesque, and the town, until modernized early in the present century by the formation of two wide thoroughfares, was a strange old place, with narrow, crooked, and steep streets and lanes, many of which still remain. It manufactures woolens, hats, silk, and cards for dressing woolen cloth. F. has long been famed for its ale. Pop. '71, 9,753. It returns one member to parliament. The once celebrated forest of Selwood was in the vicinity, and part of it remains in its original state.

FROMENTIN, ELIGIUS, d. New Orleans, 1822; a native of France, a priest and Jesuit, who settled in New Orleans, and soon after the organization of the state of Louisiana was chosen senator in congress. When Jackson was governor of the territory of Florida, F. was U. S. judge for the district.

FROMENTIN, EUGÈNE, b. 1820; a French author and painter, who studied under Cabat, and began to exhibit in 1847. In 1852, he was sent to Algeria on an archæological journey by the committee of historical monuments. He has produced many pictures of Arab life and scenery, which have been highly praised. Among them are "Chase of the Gazelles;" "Falcon Chase;" and "Arabian Falconer." He has published three or four works on art, and *Dominique*, a novel, which met with a fair measure of success.

FROND, in botany, a term often used to designate the leaves of cryptogamous plants. It was originally introduced as distinctive of organs in which the functions of stem and leaf are combined, and was applied to the leaves of palms, etc. The term *leaf* is now very generally used even as to mosses, ferns, etc., and the term *thallus* is employed as to lichens. In the case of many *algæ*, the term F. is often used to designate the whole plant, except its organs of reproduction.

FRONDE, the name given to a political faction in France during the minority of Louis XIV., which was hostile to the court and the prime-minister, Mazarin, and caused great domestic troubles from the year 1648 to 1654. The grasping and despotic policy of Mazarin, to whom Anne of Austria, the queen-regent, had abandoned the reins of government, had given offense to all classes. The princes and nobles saw themselves excluded from all high offices in the state, and their place supplied by foreigners; the parliament was threatened in its political rights, and the people groaned under the burden of taxes and administrative abuses. Parliament, therefore, commenced a course of determined opposition, refusing to register the royal edicts, more especially the disgraceful financial measures. Although the young king, then only nine years old, was obliged by several "beds of justice" (q.v.) to compel the registration of the edicts, and to forbid the opposition of the parliament, the latter did not on that account change its bearing towards the court. Mazarin, therefore, adopted violent measures. On the 26th Aug., 1648, he ordered the president, Potier de Blancmenil, and the councilor, Peter Broussel, to be arrested. The people took up arms, dispersed the Swiss guard, and on the 27th Aug. (*la journée des barricades*), erected barricades in the streets around the palais royal. The court now yielded, repealed several taxes, and promised a better administration of justice. This victory gave parliament courage; those members who continued to keep a sharp lookout on the court measures, and were styled by the adherents of Mazarin *frondeurs*—i.e., censurers (literally, "slingers")—formed the majority. The court now resolved to suppress the movement, in which the populace of the capital had also taken part, by force of arms, and, on the 6th Jan., 1649, removed secretly to St. Germain, leaving Paris to be blockaded by the prince of Condé with 7,000 men. The parliament, whose cause was now publicly espoused by the prince of Conti, the dukes of Longueville, Beaufort, Orleans, Bouillon, Elbeuf, Vendôme, Nemours, the cardinal De Retz, and the maréchal de la Mothe, called upon the people to resist, and even negotiated with the stadt-holder of the Netherlands for an auxiliary corps. In this critical position, the court, on the 11th Mar., concluded a compact at Ruel, in which both parties missed their object. After the return of the court to Paris in Aug., a new turn was given to the contest, the princes of the blood disputing the power with Mazarin. This, on the 18th Jan., 1650, led to the sudden arrest of Condé, Longueville, and Conti. This arbitrary proceeding roused the provinces. Marshal Turenne assumed the title of lieut.-gen. of the royal army for the liberation of the princes, united himself with the archduke Leopold, and took several fortified towns, but was

finally completely defeated by Mazarin's troops at Rhetel, on the 15th December. Mazarin returned in triumph to Paris, but found all parties against him, and his removal was insisted upon so urgently, that he was obliged to release the princes, and flee to the Netherlands. A disgraceful system of intrigue was now substituted for force of arms, which totally changed the position of parties, and converted the contest which had begun for the interests of the people into a court cabal. Turenne was gained over by the queen-regent, De Retz by cardinal Mazarin, and Condé was obliged to flee for safety into Guienne. Meanwhile, Louis XIV., who had now attained his 14th year, endeavored to induce the prince of Condé to return; but the latter, mistrusting these overtures, repaired to Bordeaux in 1651, where he had many adherents, whence he commenced a regular war against the court, which might have had dangerous consequences, had not Turenne opposed the prince. On the 2d July, 1652, an engagement took place between the two parties in the neighborhood of Paris. Condé was on the eve of being defeated, when the gates of Paris were opened to him by the courage and zeal of his sister, the duchess of Longueville, and thus a new turn was given to the contest. Paris itself, weary of these fruitless dissensions, now entered into negotiations with the court, demanding the final removal of Mazarin, who had meanwhile returned. This demand was complied with by Louis XIV., and a general amnesty proclaimed. Condé, who refused to enter into the compact, relying upon an army of 12,000 men placed at his disposal by Charles, duke of Lorraine, quitted Paris on the 15th Oct., 1652, and repaired to Champagne; and finally, finding no one disposed to take up arms in his cause, entered the Spanish service, for which he was declared a traitor. Soon after, Mazarin returned to Paris, and was again intrusted with the reins of government. Thus the royal power came forth victorious from this long contest, which, though it seemed to commence for the popular interests, gradually changed into a miserable party strife among the nobles. Compare Ste-Aulaire's *Histoire de la Fronde* (3 vols., Par. 1827).

FRONTAL BONE, one of the eight bones of the cranium. See SKULL.

FRONTENAC, a co. in the province of Ontario, Canada, bordering on lake Ontario, where it merges into the St. Lawrence river; traversed by the Grand Trunk and the Kingston and Pembroke railways, and the Rideau canal; 323 sq.m.; pop. '71, 28,717. The capital is Kingston.

FRONTENAC, LOUIS DE BUADE, Compte de, 1620–98; governor of the French province of Canada. He entered the military service, and became col. at the age of 17 and lieut.gen. at 29, having distinguished himself greatly. He studied the science of warfare under Maurice of Nassau, served in Italy, Flanders, and Germany; and was selected by Turenne to head the troops sent to relieve Canada. He succeeded Courcelles as governor in 1672, built fort Frontenac or Catarocow (Kingston) in 1673, but, on account of some arbitrary acts, was recalled in 1682. He encouraged and aided La Salle in colonizing the Mississippi valley, and by posts at Niagara and Mackinac, and in Illinois, assailed the English settlements, and controlled the Indians. Reappointed in 1688, when insufficient resources had brought the colony to the brink of ruin, he carried on a vigorous war against the English settlements in New York and their Indian allies, the Iroquois, who made several successful inroads to Canada. In 1690, he defeated admiral Phipps and the English fleet before Quebec, in commemoration of which Louis XIV. caused a medal to be struck. Frontenac followed up this success by invading the Mohawk country, and leading an expedition in person against Onondaga and Oneida; while on the coast he menaced Maine and New York. He struck terror into the hearts of the Iroquois; and his energy was equal to his bravery. His wife, who survived him, had been one of the beauties of the French court, and used the influence she possessed against her husband, whom she seems to have cordially hated.

FRONTIER, a co. in s.w. Nebraska, drained by tributaries of the Republican river; about 900 sq.m.; pop. '76, 243. The surface is undulating, but the soil is unfitted for agriculture, and there is very little timber.

FRONTI'NUS, SEX. JULIUS, a Roman author who flourished in the second half of the first century. In 75 A.D., he was sent to Britain as governor of that island, and obtained a great reputation by his conquest of the Silures, and his vigorous maintenance of the imperial authority. He appears to have been twice consul in the course of his life, and to have held several other important offices. He died about 105 A.D. Several works are attributed to F., only two of which are certainly genuine, the *Strategematicon*, a treatise on the art of war, in four books; and the *De Aquæductibus Urbis Romæ*, in two. The best edition of the first is that of Oudendorp (reprinted with emendations in 1779); of the second, that of Dederich (Wesel, 1841). The *De Aquæductibus* is an important contribution to the history of architecture.

FRONTISPIECE, the name generally given to an engraved and decorated title-page of a volume, or an engraving placed opposite the title-page. The term is also sometimes used to denote the front or principal face of a building.

FRONTO, M. CORNELIUS, was b. at Cirta, in Numidia, and came to Rome in the reign of the emperor Hadrian, where he soon obtained a high reputation as a teacher of eloquence. Antoninus Pius intrusted to him the education of Marcus Aurelius and Lucius Verus, both of whom always retained the warmest admiration of their preceptor.

F. gradually rose to the highest offices of the empire, became very wealthy, and died, it is thought, about 170 A.D. Until recently, nothing was known of F. as an author, except from a few fragments of a grammatical treatise (*De Differentiis Vocabulorum*); but in the year 1814, Angelo Mai discovered in the Ambrosian library at Milan a palimpsest, which being deciphered, was found to contain a considerable number of F.'s letters with some short essays. These were published by Mai in 1815; and in the following year an addition was published at Berlin by Niebuhr, who wrote a critical preface, and also printed the commentaries of Buttmann and Heindorf. A few years afterwards, Mai found in the library of the Vatican at Rome another palimpsest containing more than 100 of F.'s letters. The result was a new edition of F. by Mai (Rome, 1823), embodying the new discoveries, which was republished at Celle in Germany (1832). The contents of these letters are on the whole unimportant, although they help to confirm the good opinion which history has formed of the emperor Marcus Aurelius; and the style is vapid and declamatory.

FROSCHDORF (originally *Crottendorf*), called by the French *Frohsdorf*, is the name of a village in lower Austria, rather more than 30 m. from Vienna, and not far from the frontiers of Hungary, on the right bank of the river Leitha. It is celebrated for its splendid castle, which in recent times has acquired a kind of political importance, from having been after 1844 the residence of the duchess of Angoulême and the rendezvous of the elder Bourbon party. After the death of the duchess, it came into the possession of the comte de Chambord (q.v.), who has greatly beautified the interior.

FROSINO'NE (the *Frusino* of the Volscians) is a t. of Italy in the former states of the church, built on the slope of a hill above the junction of the river Cossa with the Sacco, about 48 m. e.s.e. of Rome, on the high-road between Rome and Naples. It is the capital of a delegation of the same name, which used to be notorious for brigandage. The only interesting edifices are the palace of the papal delegate and the remains of an ancient amphitheater. The costumes of F. are among the most admired of Italy. Pop. about 8,000.

FROSSARD, CHARLES AUGUSTE, b. France, 1807; educated in the military school at Metz, and entered the army in 1827. He was engaged in the Belgian war, and in Algeria, where he became a major. In the Crimean war, he was in command of the 2d corps of engineers. In the Italian war, he was made a gen., and at the establishment of peace, he was made an officer of the legion of honor, and appointed governor of the imperial prince. In the war with Germany, he commanded the 20th corps of the army of the Rhine, and headed the attack upon Saarbruck. He was taken prisoner at Gravelotte, and detained until the close of the war.

FROST, JOHN, LL.D., 1800–59; b. Maine; graduated at Harvard, and taught in Boston and Philadelphia. He published a great number of works, comprising school and juvenile books, and historical and biographical compilations, amongst others *Pictorial History of the United States; Picture History of the World; Lives of American Generals; Lives of American Naval Commanders; Books of the Army; Books of the Navy;* etc.

FROST. In a general sense, frost means the lowering of atmospheric temperature at the surface of the earth to or below the freezing point, 32° F. In a special sense, the term is used to signify the deposition of atmospheric moisture upon plants and other objects. It is usually stated that frost is formed by the deposition of frozen dew, which indicates that the dew is frozen before it is deposited. This is not strictly correct. It could not so be deposited in the perfect form that frost assumes. The freezing takes place at the moment of deposition of the moisture, before *dew* is formed, the surface of the object having been cooled slightly lower than the atmosphere by radiation into clear space; for a clear atmosphere, as a rule, is one of the conditions of the appearance of hoar-frost, as deposited "frost," or frozen deposited moisture, is called. It will be seen that this phenomenon requires a temperature not far below the freezing point, else the moisture will be deposited in the form of snow, or of a *very imperfect* hoar-frost. The perfection of the crystallization requires that it take place at the point of deposit.

Frost may appear suddenly without a crystalline deposit when the air is not very moist. From its effect upon vegetation, which it withers and turns dark, it is then called *black frost*. It may take place when the sky is cloudy; but clouds, because they retard the radiation of heat from the surface of the earth, generally retard or prevent the appearance of frost. A sheet placed horizontally over a bed of plants, even at some height, will often protect them from frost. A considerable amount of atmospheric moisture will often retard radiation sufficiently to avoid freezing. Some places are peculiarly favorable to the deposition of hoar-frost, and sometimes it forms in very large crystals. This is the case at Mt. Washington, when there is in some favorable locations so nice a balance between the moisture and the cold that crystals sometimes form a foot in length. A certain degree of cold will destroy the life, or at least the activity, of many species of disease germs; and it is a popular belief that the appearance of frost causes the disappearance of yellow and other fevers. This is the common belief in regard to the Mississippi valley; but in 1873, the appearance of frost did not check the fever there, probably because the cold was not sufficient. A certain elevation

of temperature will undoubtedly kill all disease germs, and a certain depression will either kill them or render them innocuous. See RADIATION, SNOW, RAIN, and VAPORIZATION.

FROST, WILLIAM EDWARD, b. England, 1810; an English painter, chiefly of portraits. In 1839, he exhibited "Prometheus Unbound," for which he received the academy's gold medal. In 1843, he won a competition prize by his cartoon "Una alarmed by the Fawns." Among his works are the "Bacchanalian Revel" and "Disarming of Cupid."

FROST-BITE is caused by cold depressing the vitality of a part or the whole of the body. The frost-bitten part is at first blue and puffy, from the current of blood through it being suspended; then, should the cold be continued, it becomes pallid, and the painful tingling gives place to numbness and insensibility, and finally to actual death or mortification. Although a sudden violent application of cold may cause death of the tissues, by reducing the temperature to a degree incompatible with animal life, the most common cause of the destructive effects of frost-bite is undoubtedly the excessive reaction which occurs on sudden removal of the cold, or the application of heat; this is especially the case with moist cold.

Baron Larrey believed that "cold was merely the predisposing cause of frost-bite, and mentions that after the battle of Eylau, the French soldiers did not experience any painful sensations during the severe cold varying from 10° to 15° below zero of Reaumur's thermometer; but when the temperature rose from 18° to 20°, they felt the first sensations of cold, and applied for succor, complaining of acute pains in their feet, and of numbness, heaviness, and prickings in the extremities. The parts were scarcely swollen, and of an obscure red color. In some cases, a slight redness was perceptible about the roots of the toes, and on the back of the foot; in others, the toes were destitute of motion, sensibility, and warmth, being already black, and, as it were, dried." Those of the men who indulged in the warmth of the bivouac fires suffered from frost-bite in much larger proportion than their more hardy comrades.

In this country, most cases of frost-bite are very trifling, the most common being chilblains (q.v.). Occasionally, in severe winters, more severe cases present themselves at the hospitals, in the persons of houseless, ill-nourished unfortunates, whose constitutions have in many instances been enfeebled by spirit-drinking.

The treatment of frost-bite consists in coaxing back by degrees the vitality of the part; this is most prudently effected by friction, at first with snow, then with water at ordinary temperature, no warmth being applied for some time. As the coldness subsides, the painful tingling returns, then redness and heat; in a short time, the latter will be above the natural standard, and if not moderated, the part will inflame, and perhaps mortify. It is well to remember that the part need not have been actually frozen for these symptoms to occur. The person with languid circulation who, coming home with cold wet feet, places them before the fire, or in warm water, may be "frost-bitten" to all intents and purposes.

FROSTBURG, a village in Alleghany co., Md., on the Cumberland and Piedmont railroad, on a plateau 1255 ft. above Cumberland river, over the great coal basin of western Maryland; pop. about 3,500. It has a number of manufactories, but is important chiefly on account of its large operations in coal.

FROTH-FLY, FROTH-HOPPER, FROG-FLY, or FROG-HOPPER, the common names of those insects of which the young—larvæ and pupæ—are found in a frothy exudation on plants. They form the family *cercopidæ* of the order *homoptera*, and are allied to *aphides*, and still more nearly to *cicadas* and lantern-flies. The larvæ and pupæ differ little in appearance from the perfect insect except that it possesses wings, which are four in number, and large. The frothy exudations in which they live are produced from the juices of the plants on which they are found; and as they are often in great numbers, crops of various kinds are not unfrequently destroyed or much injured by them, the plants being weakened by loss of sap. They have a proboscis adapted for piercing the bark of the plants on which they feed. They are all small insects. They have considerable leaping powers. *Cicada spumaria* is an extremely common species in Britain. The frothy exudation is sometimes called CUCKOO-SPIT, sometimes FROG-SPITTLE, from fancies entertained as to its origin. It is sometimes so abundant, particularly on willow-trees, that persons walking beneath are wetted by its continual dropping. In tropical countries, the *cercopidæ* are still more plentiful. Some of the tropical insects of this family are remarkable for their extraordinary forms, resulting from peculiar developments of the first segment of the thorax. This is particularly the case in the genus *bocydium*.

FROTHINGHAM, ELLEN, daughter of Nathaniel L.; b. Boston, 1835; is distinguished for her thorough acquaintance with the German language and literature, and for her admirable translations of Lessing's *Nathan der Weise*, Goethe's *Hermann and Dorothea*, and Lessing's *Laocoon*.

FROTHINGHAM, NATHANIEL LANGDON, D.D., 1793-1870; b. Boston; graduated at Harvard, where he was professor of rhetoric and oratory. In 1815, he was ordained pastor of the First church (Unitarian) in Boston, which position he occupied until 1850,

when he left the pulpit, and devoted himself to literature. He published *Sermons in the Order of a Twelvemonth*, and *Metrical Pieces*, translated and original. He also contributed largely to periodical literature. He was a thorough student of German, when such scholarship was rare in America; and his writings, especially his poetical translations, show a refined taste and an elegant diction.

FROTHINGHAM, OCTAVIUS BROOKS, b. Boston, 1822; an American clergyman, son of Nathaniel L. He graduated at Harvard college in 1843, at the Cambridge divinity school in 1846, and was settled as pastor of the North church (Unitarian), Salem, Mass., in 1847. In 1855, he became minister of a church of the same denomination in Jersey city, N. J., where he remained four years. In 1859, he accepted a call to the pastorate of the newly formed Third Unitarian Congregational church in New York, and remained at that post for 20 years, when ill-health compelled his resignation. From the beginning he belonged to the most radical wing of the Unitarian sect, and the name of his church was finally changed from the "Third Unitarian" to the "First Independent Liberal church of New York," the connection with the Unitarian denomination being thereby sundered. F. was one of the founders of the "free religious association," and its president for the first twelve years of its existence. His theology is of the rationalistic type. He ranks high as a scholar, and as a preacher is impressive and eloquent. He has contributed largely to the periodical press on a great variety of subjects, and published more than 200 sermons. He is the author of the following works: *The Parables; Stories from the Testament;* a translation of *Renan's Critical Essays; The Child's Book of Religion; The Religion of Humanity; The Life of Theodore Parker; The Safest Creed; History of Transcendentalism; Stories from the Lips of the Teacher; Stories of the Patriarchs; Beliefs of the Unbelievers; Life of Gerrit Smith.*

FROTHINGHAM, RICHARD, JR., b. Mass., 1812; for many years member of the editorial staff of the Boston *Post.* He represented Charlestown in the state legislature for five sessions, and was three times chosen mayor of that city. In 1853, he was a member of the state constitutional convention. He has published *History of Charlestown; History of the Siege of Boston;* and the *Battles of Lexington, Concord, and Bunker Hill; Account of the Bunker Hill Monument; Life of Gen. Joseph Warren;* and *Rise of the Republic.*

FROUDE, JAMES ANTHONY, an English historian, was b. at Totness, in Devonshire, in the year 1818; studied at Oriel college, Oxford, where he took his degree in 1840; and in 1842, was elected a fellow of Exeter college. Having abandoned his original intention of entering the church, he published, in 1847, a volume of stories, entitled *The Shadows of the Clouds;* and two years later, *The Nemesis of Faith*, a work in which the solemnity and sadness of religious skepticism are relieved by a singularly tender and earnest humanity. The book was written with great and even startling power, and not only cost F. his fellowship, but also a situation to which he had just been appointed in Tasmania. F., for the next few years, employed himself in writing for *Fraser's Magazine* and the *Westminster Review.* His *History of England from the fall of Wolsey to the defeat of the Spanish Armada*, appeared from 1856 to 1869. The peculiarity of this work consists in the use it makes of, and the value it places upon, the state documents of the time, the study of which led F. to reverse not a few historical verdicts, especially that upon Henry VIII. Two vols. of *Short Studies on Great Subjects* appeared in 1867, and a third in 1877. He was elected rector of St. Andrews university in 1869, and received the degree of LL.D. For a short time F. was editor of *Fraser's Magazine.* In 1872, F delivered a series of lectures in the United States. *The English in Ireland in the Eighteenth Century* was published in 1872–74. In 1874, and again in 1875, F. visited our South African colonies on a mission from the home government.

FROZEN STRAIT, a passage, if passage it can be called, leading n.w. from Fox's channel towards Repulse bay. It separates Southampton island, in the n. of Hudson's bay, from Melville peninsula, which stretches northward to the strait of the Fury and Hecla. Its narrowness, for it is only 15 m. wide, renders it, even in the 66th degree of latitude, almost constantly impervious to navigation.

FROZEN WELLS are common in the extreme northern United States. One in Brandon, Vt., 85 ft. deep, shows a mass of frozen gravel 15 ft. thick, congealing 14 ft. below the surface. Even in summer the walls are covered with ice several inches thick, and the temperature is seldom above the freezing point. The water freezes over in winter.

FRUCTED. Trees when represented as bearing fruit are said heraldically to be fructed.

FRUCTIDOR (Eng. "fruit-month") was the name given in the republican calendar of France to the period extending from the 18th of Aug. to the 16th of Sept. The 18th F of the year 5 (or the 4th Sept., 1797) is celebrated as the day on which Barras, Rewbel, and Lepaux, members of the directory, by a *coup d'état*, saved the republic from the machinations of the royalists, who had got the upper hand in the council of five hundred. The execution of the *coup d'état* was intrusted to gen. Augereau.

FRUCTIFICATION (Lat. the producing of fruit), a term frequently employed in cryptogamic botany, sometimes to denote the whole reproductive system, and sometimes the fruit itself.

FRUCTOSE, or FRUIT-SUGAR, known also as INVERTED SUGAR, occurs in association with glucose, or (according to the recent investigations of Buignet) with cane-sugar in many ripe acidulous fruits. In its composition, and in most of its properties, it closely resembles glucose, from which, however, it differs (1) in being incapable of crystallization, and (2) in its action on polarized light; while both glucose (or grape-sugar) and cane-sugar exert a right-handed rotation upon a ray of polarized light, this variety of sugar exerts a left-handed rotation; and hence the term *inverted* has been applied to it.

The composition of F. is represented by the formula $C_{12}H_{12}O_{12}$. When boiled with dilute acids, F. combines with the elements of water, and passes into glucose. A similar passage of this substance into glucose sometimes occurs spontaneously, as is seen in the gradual crystallization of the sugar in dried fruits.

It appears to be procurable only from cane-sugar (or sucrose) by the action either of acids or of a peculiar albuminous ferment which exists in the juice of many ripening fruits.

FRUGO'NI, CARLO INNOCENZO, a much admired and versatile Italian poet, was b. at Genoa in 1692, and educated for the church. In 1716, he began to teach rhetoric at Brescia, at which time he had already acquired the reputation of being an elegant writer of prose and verse, both in Latin and Italian. In 1719, he taught in Genoa, and subsequently at Bologna. At the court of Parma, through the patronage of the cardinal Bentivoglio, he was appointed poet-laureate, the stated and prescribed compositions of which post were highly uncongenial to his original and discursive muse; nevertheless the dukes of Parma showed particular favor to the poet, who returned to Genoa on the death of duke Antonio, and the accession of the Spanish infante. In 1733, pope Clement XII. released F. from his spiritual vows, which had at all times been highly distasteful to him. A grand ode, in celebration of the capture of Oran by the Spaniards, and some other poetic addresses to the king and queen of Spain, reinstalled the poet in his former post at the Parmese court. He died in 1768. His numerous writings were published at Parma, 1779, and a complete edition at Lucca, 1779. A selection from his works appeared at Brescia, 1782.

FRUIT, *Fructus*, in the botanical use of the term, in phanerogamous plants, is a mature ovary containing a seed or seeds; and in cryptogamous plants, a spore-case (*sporangium* or *theca*) containing spores. Other parts of the flower, most frequently the calyx, sometimes remain after flowering is over, undergo a further development, become incorporated with the ovary, and form part of the fruit. The development of the F. in phanerogamous plants depends upon the fertilization of the ovules, and when this has not taken place, the flow of sap to the ovary usually soon ceases, and it drops off with all the other remains of the flower; although there are exceptional cases of seedless fruits, as seedless oranges, bananas, grapes, barberries, etc., in which, however, it may be supposed that fertilization takes place, and that unknown causes afterwards operate to prevent the development of the seed, and to direct the flow of sap more exclusively to the nourishment of the succulent parts, which are thus increased and improved. This supposition is rendered more probable by the circumstance that the production of seedless fruits appears to be at least sometimes a consequence of age and diminished vigor in trees.

The F., like the ovary, may be composed of one carpel, or of more than one. But the F. sometimes differs from the ovary, through the development of some of the parts, and the non-development or obliteration of others; so that an ovary with several cells may be converted into a one-celled F.; and of several ovules, all but one may become abortive, so as to produce a one-seeded fruit. Thus the three-celled ovary of the oak and of the hazel, with two ovules in each cell, becomes, by the non-development of two cells and five ovules, a fruit with one seed; and the two-celled ovary of the ash, and the three-celled ovary of the cocoa-nut, likewise produce one-celled and one-seeded fruits. Sometimes also false dissepiments are formed, which produce in the F. a greater number of cells than existed in the ovary. More generally, however, the F. agrees with the ovary in the number of its cells and seeds. But not unfrequently, the structure of the F. is rendered comparatively difficult to determine, through the development of succulent matter or pulp, sometimes in one part and sometimes in another.

All that is external to the proper integuments of the seed in the ripe F. is called the *pericarp* (Gr. *peri*, around; and *karpos*, fruit); and this, which varies extremely in size and other characters, usually consists of three layers, the outermost of which is called the *epicarp* (Gr. *epi*, upon); the middle one, the *mesocarp* (Gr. *mesos*, middle), or sometimes the *sarcocarp* (Gr. *sarx*, flesh); and the innermost, the *endocarp* (Gr. *endon*, within). These parts exhibit great variety, but it is generally the mesocarp which becomes succulent or fleshy, as in the peach, cherry, plum, and other drupes; and in the pear, apple, and other pomes. In drupes, or stone-fruits, the endocarp is the hard shell which immediately covers the seed; in pomes, it is the scaly lining of the seed-bearing cavities in the center; in both drupes and pomes, the epicarp is the outer skin. So in melons, cucumbers, and gourds, the succulent part is the mesocarp, greatly developed, with a thin epicarp and a thinner endocarp. In the orange, however, and all of that family, the epicarp and mesocarp together form the rind, whilst the pulpy cells belong to the

endocarp. In berries, as the gooseberry, grape, etc., the pulpy matter does not belong to any of the layers of the pericarp, but is formed from the placentas of the seeds.

When the fruit, as the fully developed ovary, is considered as a modified leaf or leaves, the epicarp is viewed as representing the epidermis of the lower surface, the endocrap the epidermis of the upper surface, and the mesocarp the substance (*parenchyma*) of the leaf. The midrib of the leaf is traced in the *dorsal suture* of the fruit or of each component carpel, and the *ventral suture* is formed by its folding together and the conjunction of its edges. The dorsal and ventral sutures are very obvious in the pods of pease, beans, etc.; and even in fruits formed of several carpels intimately combined, they often become very apparent when the ripened fruit opens to allow the escape of the seeds. The opening or *dehiscence* (Lat. *dehisco*, to open) of fruits takes place in various ways; thus, the fuit sometimes resolves itself into its original carpels by separation through the *dissepiments*, which divide into two plates forming the sides of the valves, and the carpels further open by their sutures; the pericarp sometimes splits at once by the dorsal sutures of the carpels; sometimes it divides transversely, and throws off a lid; sometimes it opens more partially by pores, etc. Many fruits, however, are indehiscent, some of which are fruits having a very hard pericarp, as nuts, and some are fruits having a soft pericarp and much pulp. The decay of the pericarp is in these cases necessary to the liberation of the seeds, unless when this is accomplished by such means as the fruit becoming the food of animals, by which also the seeds of plants are often widely distributed. The decay of the pericarp seems intended, in many cases, to provide the first nourishment for the young plants which spring from the seeds.

A classification of the different kinds of fruits is extremely difficult, although they afford characters of great importance in descriptive and systematic botany. A convenient primary division of fruits is into those which are formed from one flower, and those which are formed by incorporation of the ovaries of many flowers. Fruits formed from one flower, by far the most numerous of these two classes, are divided into *apocarpous* and *syncarpous*, or into *apocarpous*, *aggregate*, and *syncarpous*. Apocarpous fruits are formed of one carpel, and are either dry or succulent, dehiscent or indehiscent, one-seeded or many-seeded. Aggregate fruits, sometimes included among the apocarpous, are formed of several or many free carpels; sometimes dry, sometimes succulent; sometimes arranged on a convex or elevated receptacle; which becomes succulent in the strawberry, and constitutes the edible part of the F.; sometimes within a concave receptacle covered by the enlarged tube of the calyx, as in the rose. Syncarpous fruits are formed of several carpels, intimately united in their mature state, so as to form a berry, capsule, pome, silique, etc. Syncarpous fruits sometimes so completely resolve themselves into their original carpels, that these may be regarded as becoming separate achenia. Fruits formed by incorporation of the ovaries of many flowers (collective or anthocarpous fruits) are sometimes dry, as the cones of firs; sometimes succulent, as the pine-apple, the mulberry, and the fig. For further notice of different kinds of fruits, we must refer to particular articles in which they are described, as achenium, berry, capsule, drupe, nut, pome, pod, silique, etc., and to articles on the plants which produce them.

A few plants, particularly the *coniferæ* and *cycadaceæ*, produce seeds really naked or destitute of pericarp. Many other seeds were formerly often described as naked, in which the pericarp exists intimately incorporated with the seed, as the seeds of grasses, *boragineæ*, *labiatæ*, *umbelliferæ*, etc. The real nature is often made apparent by some trace of the style.

The production of ripe F. is exhaustive to the energies of a plant, and plants ordinarily annual may be preserved in life for several years by preventing it. Very young fruit-trees generally fail to bring F. to perfection, and the first flowers of melons and gourds are often, for a similar reason, abortive; whilst, on the contrary, any circumstance that favors an accumulation of sap in a particular season, tends to render fruit-trees unusually productive in the next, as when the whole blossoms of a year are killed by frost, or when, from the coldness of the previous summer, flower-buds have not been formed in abundance. Whilst the vital energies of a plant are directed mainly towards the increase of its size, flower-buds are sparingly formed or not at all, as is often the case with fruit-trees growing very luxuriantly, and various modes are adopted to cause the production of flower-buds and of fruit by checking this luxuriance of growth, as by root-pruning, by cutting into the stem of wall-trees to a moderate depth, or by taking off portions of the bark of the stem. Grafting (q.v.) is also of use in this respect, as well as for the propagation of improved varieties of fruit-trees, the qualities of which would, in all probability, not be found exactly the same in their offspring by seed.

In a very immature state, fruits are in general green and soft, and decompose carbonic acid gas in the sunlight, absorbing the carbon, and setting free the oxygen, like leaves and other green parts of plants. As they advance towards maturity, some of them become externally dry and hard, and cease to perform by their surface these functions of vegetation; others, as they become more succulent, change their color, and instead of absorbing carbon and liberating oxygen, absorb oxygen from the atmosphere, and exhale carbonic acid.

It would not be easy to enumerate the peculiar substances which are produced in fruits. Different parts of the same F. are often extremely different from one another, as the milk and the kernel of the cocoa-nut, its hard shell, and its fibrous husk. Seeds are indeed generally very different in all their qualities from the pericarp or the pulp by which they are surrounded, and the integuments of the seed often not less different from the embryo, of all which a ready illustration may be found in the apple or the grape. The most different chemical products of vegetation are sometimes to be found in different parts of the same F., giving them the most varied qualities, as wholesome and poisonous; the succulent part of the F., from the kernel of which strychnia is obtained, is said to be harmless, and the seeds of plums contain so much hydrocyanic acid, that to eat many of them would be dangerous; the capsule of the poppy yields opium, but its seed contains nothing of the kind, and is bland and nutritious, abounding in a wholesome fixed oil. The value of fruits to man—which may safely be asserted to exceed that of all other parts of plants—sometimes, as in the corn-plants, chiefly depends on the farinaceous matter of their seeds, containing starch, gluten, etc.; sometimes, as in the banana and bread-fruit, on the starchy matter of the pulpy part; sometimes, as in nuts, on fixed oils; sometimes, as in many succulent fruits, on sugar and various acids, with gum, pectine, etc. Other fruits, or parts of the same fruits, are valuable for the volatile oils which they yield, and for peculiar principles capable of application to medicinal and other uses, or making them capable of being used as condiments, perfumes, etc. Coffee, cocoa, pepper, vanilla, and many other articles of commerce, are obtained from fruits.

Whilst some fruits are of the highest value as articles of food, others are generally regarded rather as articles of luxury; yet the abundance of succulent fruits in tropical climates is a bountiful provision for real wants, contributing much to the health of the inhabitants. The coolness of succulent fruits renders them peculiarly grateful amidst the heat of the tropics; their temperature, when newly gathered, being much below that of the surrounding atmosphere.

Cultivated Fruits.—In its popular use, the term F. sometimes has almost the same signification as in the language of botanical science; sometimes it is employed as almost exclusively designating the edible succulent fruits. We cannot attempt an enumeration of edible fruits; many will be found noticed in other botanical articles; we can only here observe that they belong to many and very different natural orders, both of endogenous and exogenous, but chiefly of exogenous plants. We propose, however, to conclude this article by an enumeration of the principal cultivated succulent fruits, including those which are important as articles of food or of commerce.

ENDOGENOUS PLANTS.

Musaceæ.	Plantain and banana.
Bromeliaceæ.	Pine-apple.
Palmæ.	Date.

EXOGENOUS PLANTS.

Moraceæ.	Fig.
	Sycamore.
	Mulberry.
Artocarpaceæ.	Bread-fruit.
Lauraceæ.	Avocado pear.
Solanaceæ.	Love-apple or tomato.
	Egg-plant.
Sapotaceæ.	Mammee sapota.
	Sapodilla.
	Star-apple.
Ebenaceæ.	Date plum.
	Kaki.
Oleaceæ.	Olive. [Differs very much in its nature and uses from all the other fruits here enumerated.]
Vacciniaceæ.	Cranberry.
Cornaceæ.	Cornel.
Myrtaceæ.	Rose-apple.
	Malay apple.
	Ugni.
	Guava.
	Pomegranate.
Grossulariaceæ.	Gooseberry.
	Red (and white) currant.
	Black currant.
Cactaceæ.	Prickly pear, or Indian fig.
Cucurbitaceæ.	Melon.
	Water-melon.
	Cucumber.
	Pumpkin.
	Squash.
	Gourd.
Passifloraceæ.	Granadilla.
Papayaceæ.	Papaw.
Rosaceæ.	Apple.
	Pear.
	Quince.
	Medlar.
	Loquat.
	Peach and nectarine.
	Apricot.
	Plum.
	Cherry.
	Raspberry.
	Strawberry.
Leguminosæ.	Tamarind.
Anacardiaceæ.	Cashew-apple.
	Mango.
	Hog plum.
	Otaheite apple.
Rhamnaceæ.	Jujube.
Oxalideæ.	Carambola.
Vitaceæ.	Grape.
Sapindaceæ.	Akee.
	Litchi.
	Longan.
	Rambutan.
	Honey berry.
Malpighiaceæ.	Barbadoes cherry.
Clusiaceæ.	Mammee apple.
	Mangosteen.
Aurantiaceæ.	Orange.
	Lemon.
	Citron.
	Shaddock.
	Forbidden fruit.
	Lime.
	Wampee.
	Marmelos.
Sterculiaceæ.	Durion.
Anonaceæ.	Custard apple.

Nuts, and along with them some fruits which, although not botanically nuts, resemble them in qualities and uses, will be noticed in a separate article.

Chemical Composition of Fruits.—Our principal knowledge of the composition of different kinds of F. is due to the recent investigations of Fresenius, which are published in the *Annalen der Chemie und Pharmacie* for 1857. In that memoir, he gives the results of upwards of 50 analyses of different fruits, including gooseberries, currants, strawberries, raspberries, mulberries, grapes, cherries, plums, apricots, peaches, apples, and pears. • We select the following analysis as representing the composition of some of our most important fruits—viz. (1) the gooseberry; (2) the grape; (3) the cherry; (4) the peach: (5) the apple; and (6) the pear. For the purpose of comparison, the free acid which is present, whether it be malic, citric, or tartaric (all of which occur in fruits), is calculated as hydrated malic acid.

		1.	2.	3.	4.	5.	6.
Water		85.36	79.98	79.70	82.01	85.04	83.95
Solid constituents		14.64	20.02	20.30	17.89	14.96	16.05
Soluble.	Glucose and fruit sugar	7.51	13.78	10.70	1.58	7.58	7.00
	Free acid	1.38	1.02	0.56	0.77	1.04	0.07
	Albuminous substances	0.37	0.88	1.01	0.89	0.22	0.26
	Soluble pectine, gum, etc	2.11	0.50	0.67	9.28	2.72	3.28
	Soluble mineral constituents	0.24	0.46	0.60	0.76	0.44	0.28
Ins'ble.	Stone or seeds; Skin and cellulose	2.08	2.59				
	Stone or seeds			5.78	3.21	0.38	0.39
	Skin and cellulose			0.37	0.94	1.42	3.42
	Pectose	0.96	0.94	0.66	1.00	1.16	1.34
	Insoluble mineral constituents	0.17	0.12	0.08	0.10	0.03	0.05

Glucose and fruit-sugar or fructose, are described in the articles devoted to these subjects. Under the heading "Soluble Pectine, Gum, etc.," are included coloring matters, fatty or oily matter in a state of suspension, and organic acids in combination with bases. We shall endeavor to explain briefly the nature of the substances designated in these analyses as pectine and pectose. The term *pectine matters* is applied to a very widely distributed class of substances occurring in the vegetable kingdom, and especially abundant in fleshy fruits and in roots, but whose properties and composition require further investigation. The substance termed *pectose*, which is insoluble in water, occurs in plants, which likewise possess a ferment in solution which converts pectose into *pectine*, which is soluble in water, and is the main constituent of apple and other fruit jellies. According to Fremy, *pectic acid*, which is closely allied to pectine, is formed in fruits that yield jellies (he has assigned formulas to both these substances, but they are not generally accepted).

The ratio in which the free acid stands to the sugar varies extremely. For a unit of free acid, the sugar is represented by 1.63 in plums, by 3.00 in currants, by 4.37 in strawberries, by 4.93 in gooseberries, by 7.03 in damsons, by 11.16 in apples, by 17.29 in sweet cherries, by 20.18 in grapes, and by 94.60 in pears; the percentage of sugar is least (1.57 per cent) in peaches, and greatest (14.93 per cent) in grapes; while the percentage of free acid is least in pears (0.07 per cent), and greatest in currants (2.04 per cent.

Fresenius observes, that as all the fruits contain albuminous or proteine matters, they are serviceable as tissue-forming food; but the albuminous matters are present in such small quantity, that these fruits will not serve without other nitrogenous food to keep the body in health. Thus, to obtain an amount of albuminous matter equivalent to the contents of one egg, we must eat more than a pound of cherries, nearly a pound and a half of grapes, two pounds of strawberries, more than two pounds and a half of apples, or four pounds of pears. They are, however, of more use as respiratory or heat-giving foods. Fresenius calculates that 1 pound of starch (which is equivalent to about 5.5 pounds of potatoes), may be replaced by 5.4 pounds of grapes, 6.7 of cherries or apples, 10.8 of currants, or 12.3 of strawberries. Fruits are, however, taken not so much for their amount of material nourishment, as for their vegetable salts (which are of great therapeutic utility), and for their agreeable flavor. In tracing the connection between the flavor and the chemical composition of fruits, Fresenius finds that the former depends (1) on the ratio in which the acid stands to the sugar, gum, pectine, etc. (the last-named substances making the ratio in which the acid stands to the sugar; (2) on the presence and delicacy of the aroma; (3) on the proportions between the soluble matters, the insoluble matters, and the water; thus, we usually attach the highest value to those fruits which contain the largest amount of soluble, and the smallest amount of insoluble matters—a peach or a green-gage almost melts in the mouth, because these fruits are relatively poor in cellulose and pectose; while, on the other hand, bilberries represent the opposite extreme, and are rich in insoluble ingredients; (4) on cultivation, which is found to cause an increase in the quantity of sugar, and a diminution of the amount of free acid and of insoluble matters; (5) and on favorable seasons, which augment the sugar and other soluble constituents.

The different berries contain, as a general rule, a larger proportion of free acid than stone-fruit or apples and pears; and their acidity is the more obvious to the taste from their containing relatively small quantities of gum and pectine. The following remarks on some of our common varieties of fruits are of practical value.

In *gooseberries*, we recognize an agreeable proportion between the sugar and the acid, the ratio being as 6 to 1 in the sweeter kinds, and 4 to 1 in less sweet varieties of this fruit. The yellow kinds are far richer in soluble ingredients than the red.

Currants are so acid to the taste, that they are almost always eaten with sugar; the ratio of the sugar to the acid being about 8 to 1.

In *strawberries*, it is the aroma that we chiefly prize. The ratio of the sugar to the acid varies with the season and the species from 2 to 1 to 6.7 to 1 (in the pine-apple strawberry).

A similar remark applies to *raspberries*. In wild raspberries, the ratio is as low as 1.8 to 1, while in cultivated kinds it is as high as 3.5 to 1.

Grapes exceed all other fruits in their amount of sugar, which is seldom less than 12, and sometimes reaches 26 per cent. In good kinds, and in favorable seasons, the ratio of the sugar to the acid is as 29 to 1; in inferior kinds, and in ordinary seasons, it is as 16 to 1; when the ratio falls to 10 to 1, the grapes are unripe and acid. In other fruits, this would be a high ratio, and they would be regarded as sweet. The anomally may be thus explained. In unripe grapes, the skins are very thick, and contain an extremely acid juice, which overcomes the sugar contained in the interior of the berry. The juice of such grapes is found to be far sweeter than the grapes themselves.

From their large amount of sugar, and from the fact that their acidity for the most part depends on the acid tartrate of potash, which is almost entirely precipitated from the wine, grapes are incomparably superior to any other fruits in the preparation of wines; and in their fermentation, different varieties of ether of a delicate odor are formed, which, in association with volatile oils that are also present, communicate to the more valued wines their special *bouquet*.

The ratio of the acid to the sugar in the must (the expressed juice before the commencement of fermentation) affords the best evidence of the season. Thus, in the very bad wine-year of 1847, the ratio was 1 : 12; in the better wine-year of 1854, it was 1 : 16; while in the good wine-year of 1848 it was 1 : 24, the same kind of grape being experimented upon in all the cases.

Apricots and *peaches* consist almost entirely of juice, their solid constituents, after the removal of the stone, being only 1 or 2 per cent. These fruits are esteemed both for their juicy and tender flesh, and for their powerful but delicate aroma.

In *apples* and *pears*, we have an increased quantity of cellulose and pectine, and consequently a relative preponderance of the insoluble constituents. The cellulose contributes to the firmness or hardness of these fruits, while it is to the pectine that they owe their property of gelatinizing when boiled. The well-marked differences of taste, etc., presented by different kinds of apples and pears, are due to the very varying relations that occur between the acid, the sugar, and the pectine, to the greater or less abundance of cellulose, and to the varying nature of the aroma. For equal quantities of sugar, pears contain less acid than apples. In the different kinds of dessert apples, the ratio of the sugar to the acid ranges between 12 to 1 and 22 to 1, while in cooking-apples it averages not more than 8 to 1.

The chemical changes which take place in the F. during the process of ripening are described in the article PHYSIOLOGY, VEGETABLE.

Keeping of Fruit.—Many of the finest fruits undergo very speedy decomposition; and on this account, some of those most highly esteemed in the countries which produce them, have never become articles of commerce, and are only to be enjoyed—except in the state of *jam* or *preserves*—during the season of their ripening. Decomposition takes place most rapidly when fruits are exposed to the air, and particularly to stagnant air, when there is any dampness about them, and when they are subjected to considerable or frequent changes of temperature. Grapes are imported into Britain from the south of Europe, packed in saw-dust. Unripe gooseberries are kept for making tarts in winter, in bottles or jars, filled up with perfectly dry sand, saw-dust, bran, or the like, closely corked and sealed, after a gentle heat has been applied to expel moisture as much as possible, and placed in a moderate and equable temperature, which is sometimes accomplished by burying them to some depth in the earth. A similar method may be employed with many other fruits. Pears, the finest kinds of which are very apt to rot almost immediately after they reach their perfect maturity, may be kept for months in glazed earthen ware jars very closely covered, and placed in a cool airy situation, out of the reach of frost. The layers of F. are separated by the substance used for filling up the interstices, and the pears of the same layer are likewise kept apart, that rottenness in one may not infect the rest, which, with every kind of F., is very apt to take place. . Another method is to keep them in drawers, the temperature being carefully regulated. Large gardens are often provided with a F. room, in which shelves and drawers are allotted to the different kinds of fruit. A moderate and equable temperature, dryness, and careful ventilation, are the principal requisites of the F. room. F. intended for keeping should be carefully gathered, when almost quite ripe, and all bruising avoided. Pears or apples shaken from the tree cannot be expected to keep so well as those gathered by the hand. Of all the succulent fruits produced in Britain, the apple keeps best, and is therefore most generally used. F. intended for keeping is sometimes *sweated* before being placed in the jars or shelves; being laid in heaps for a short time—varying according to the kind of F., and extending, in the case of

winter-apples to a fortnight or more—that some of the juice may exude through the skin; but the propriety of this practice is doubtful. Some kinds of winter pears and apples can scarcely be said to be ripened till after they are placed in the F. room; and medlars are not fit for use till they have reached a state of incipient decay.

FRUIT (*ante*). The wild grape of New England would appear to be the first fruit authentically recognized as indigenous to the American soil. During the early explorations of the country undertaken by the Northmen, a German who accompanied them became greatly interested upon finding a fruit which recalled the vines of his native land. As the civilization of the country progressed, other fruits were imported by the settlers from different European countries. The French and Spanish missionaries, as they established churches, monasteries, and convents, brought their favorite home productions to the country of their adoption. In every district peopled by them, the cultivation of the soil repaid them with abundant fruit harvests. The early settlers in Virginia imported apples, pears, plums, and the hardy varieties of English fruits; while the Germans and French introduced the European vine stocks. California owes the abundant vintage of to-day to the enterprise of the Jesuits, whose followers paid great attention to the cultivation of the vine. From the middle of the 17th c., increasing attention was paid by the intelligent portion of the communities to the culture of fruit, but there is no authentic record of the establishment of nurseries for the exclusive rearing of fruit trees until the end of the year 1800, when they were estimated at four or five. It is difficult to arrive at any authentic statistics of this branch of enterprise, for no reliable record has been kept by any of the states, with the one exception of Michigan, which in 1874 returned a statement as to its orchards and the fruit harvest of that year, in which their money value was estimated at $3,537,278, and the revenue from the grape-vine alone as $22,015. Considering this estimate, and deducing from it an approximate idea of the relation of the fruit crop to the extent of the country, we can, by considering the climate and fruit-growing facilities of the other states in relation to their area, gather what may be taken as a fair estimate of the revenue derived from the cultivation of fruit throughout the union. We arrive at the conclusion, that the sum of $46,724,293 may fairly represent the value of the fruit culture at the date of this estimate—1874.

In the same way, for the same reason, it is difficult to arrive at the number of varieties of each kind of American fruit; but it appears that, while the European countries produce the greatest varieties in pears, cherries, and strawberries, the United States bears the palm as regard apples, hardy grapes, and peaches.

FRUIT-GARDEN. Some kinds of fruits have been cultivated from the earliest historic ages. To say nothing of the garden of Eden, and the vineyard which Noah planted after the deluge, we find in the books of Moses evidence that the cultivation of fruits was much practiced in Egypt before the time of the exode of the Israelites; and amongst the Babylonians, the Persians, the Chinese, and the inhabitants of India, it can in like manner be traced back to the most remote antiquity. The Greeks and Romans probably derived their knowledge of the art, as well as many of their finest varieties of fruit-trees, from the east; Charlemagne required attention to be paid to it throughout his wide dominions, and contributed much to its extension in regions of Europe previously too rude for its prevalence; and during the middle ages it was most successfully prosecuted by the monks in the gardens of the monasteries.

The grape, the fig, the melon, and the pomegranate, are among the first fruits of which we find any particular notice in history. The cultivation of the apple, the pear, and some others, is also unquestionably of very great antiquity. Interesting particulars concerning the most important kinds of fruit, will be found under their respective heads.

The cultivation of fruits is generally carried on in connection with that of culinary vegetables, flowers, and other objects of the gardener's care; and the fruit-garden is almost necessarily more or less combined with the kitchen-garden, etc. The term fruit-garden is generally used when the ground between fruit-trees is regularly tilled and made to produce other garden crops; the term orchard (q.v.), when it is laid down in grass, or cultivated for grain and other agricultural crops. The latter method is practicable only with some, and these the more hardy kinds of fruit-trees.

Fruit-trees, in the open air, are cultivated either as wall-trees, espalier-trees, or standards. The walls intended for fruit-trees are either of brick or stone, the former, however, being preferable, and are generally from 10 to 14 ft. high. Walls serve not only for protection from winds, but for the radiation of heat, and thus counterbalance in part the disadvantages of cold climates. The training of wall-trees will be noticed in a separate article. See WALL-TREES. Espaliers (q.v.) serve in an inferior degree the purposes of walls. Walls are sometimes flued and artificially heated, by which means early ripening is secured, and varieties of fruit are produced which could not otherwise in the same locality be grown in the open air. The production of fruits belonging to warm climates is also effected in the colder parts of the world by means of hot-houses (q.v.), in which the trees are generally trained either as wall-trees or on frames stretched almost horizontally, both methods being commonly adopted in the same hot-house. Standard trees, which receive no other training than mere pruning, or the occasional

tying of a principal branch, to guide it in a particular direction, are further distinguished according to the height of their stem before branching, as *full standards*, with stems 6 or 7 ft. high, more common in orchards where cattle are sometimes allowed to graze, than in gardens; *half-standards*, with stems 3 to 5 ft. high; and *dwarf standards*, which, being otherwise also of small dimensions, and often bearing very fine fruit, and in great abundance, are particularly suitable for many situations, and for small gardens. The height of the stem is determined in the nursery, before grafting; but much depends upon the kind of tree; and all the varieties of some kinds may be permanently dwarfed by grafting on particular kinds of stock, as apple-trees by grafting on *paradise* stocks. Other means of still further dwarfing are practiced as to trees intended for forcing (q.v.), and to a remarkable extent by the Chinese in the cultivation of the dwarfed trees (q.v.), for which they are famous.

The soil of the fruit-garden requires particular attention. Different kinds of fruit-trees differ, indeed, as to the soils to which they are specially adapted, or in which they will succeed; but a rich and rather open soil is the most generally suitable. This soil must be of the depth of at least 2 ft., and it is better that it should be 3 or more; it must extend to a distance of at least 8 or 12 ft. from the trees, if they are not very dwarf. If the roots reach a bad subsoil, such as gravel or *till*, canker is almost sure to ensue. The care bestowed on the preparation of the soil for fruit-trees by the monks of the middle ages has seldom been equaled, and never exceeded in modern times. The whole soil of large gardens appears in some instances to have been artificially prepared; and the descent of the roots to an unfavorable subsoil was prevented by pavements. It is, of course, absolutely requisite that a fruit-garden be thoroughly drained. Manuring is sometimes unavoidable, but is apt, when injudiciously applied, to cause diseases in the trees; and when the soil requires to be enriched, road-scrapings, the scourings of ditches, rotten leaves, etc., are to be preferred. The use of guano and other artificial manures requires great caution. Where full crops of culinary vegetables are taken from the soil around the trees, there is less danger of injury from manures, although the practice, however necessary in many cases, is not the best either for the quality of the vegetables or the fruit.

The fruit-trees cultivated in Britain are almost always grafted or budded on seedling stocks either of the same or a nearly allied species. See GRAFTING. The raising and grafting of these stocks are generally carried on in the nursery (q.v.). Some kinds of trees are propagated by layers or by suckers, and some by cuttings, the common method of propagating the varieties of gooseberries and currants. In warmer climates, these methods of propagation are more extensively used, and ungrafted seedlings are also more frequently allowed to become trees and to produce fruit. Concerning the transplanting of young fruit-trees, see TRANSPLANTING.—PRUNING will also be noticed in a separate article.—The methods of preserving the blossom from spring frosts being almost exclusively applicable to wall-trees, will be noticed under that head.

Besides fruit-trees, properly so called, some shrubs or bushes are much cultivated in Britain for the fruit which they produce, particularly the gooseberry, the red and white currant, and the black currant. Some of the fruits of tropical countries are in like manner produced by shrubs. The raspberry is only half-shrubby, the strawberry completely herbaceous; and these are the only half-shrubby or herbaceous plants much cultivated in the open air in Britain for their fruit. But in warmer climates, some of the most valuable fruits are produced by herbaceous plants, as the melon, cucumber, pumpkin, and all the kinds of gourds, the pineapple, and, notwithstanding the tree-like size of the plants, the plantain and banana.

FRUIT-PIGEON, *Carpophaga*, a genus of *columbidæ* (q.v.), having the bill considerably depressed at the base, compressed and moderately arched at the tip, the membrane in which the nostrils are pierced little prominent or swollen, the forehead low, and the feathers advancing on the soft part of the bill, the wings moderately long, the feet, and particularly the hinder claw, large, and formed for grasping. During the breeding-season, a curious gristly knob grows on the base of the upper mandible of some of the species, and soon after disappears. They are birds of splendid plumage, natives of the forests of India, the Indian archipelago, the warmer parts of Australia, and the islands of the Pacific ocean. Their food consists of fruits.

FRUITS, in law. The fruits of the soil, in their legal aspects, fall under various categories, and follow different destinations according to their nature, and the situation in which they are placed. If not yet separated from the soil which produced them, they are said to be *pendentes*, and as parts of the soil (*partes soli*), pass to the heir on the death of the ancestor, or are carried by a sale to the purchaser. To this, however, there is an exception in the case of industrial fruits (*fructus industriales*), such as growing corn, and all those other fruits which require yearly seed and industry. These are called in England *emblements*, and "though still in union with the soil, follow nevertheless, in several particulars, the nature of personal, as distinguished from real estate."—Stephen's *Com.* ii. 227. The rule is the same in Scotland, but it is strictly construed, and does not include trees or planting, natural grass, or even fruit not yet plucked from the tree. To this again, however, there is an exception in horticultural subjects, in favor of nursey-trees and plants, not of larger or longer growth than such as are usually

delt in by nurserymen. See FIXTURES. Fruits that are separated from the soil (*fructus percepti*), on the other hand, are the property of the possessor who separated them in good faith; of the tenant or former proprietor in the case of a sale; and of the personal representatives of the deceased in case of death, and not of the heir of his real or heritable estate.

The act 7 and 8 Geo. IV. c. 30, "for consolidating and amending the laws of England relative to malicious injuries to property," applies to trees, saplings, shrubs, and underwood; to plants, fruits, and vegetable productions in gardens, orchards, nursery-grounds, hot-houses, green-houses, or conservatories; and to various kinds of cultivated roots and plants not growing in a garden, orchard, or nursery-ground. The punishments are proportioned to the injury done, whipping in certain cases being added to the statutory punishments in the case of males, by 16 and 17 Vict. c. 99, and 20 and 21 Vict. c. 3. This statute (7 and 8 Geo. IV. c. 30) is limited to England, but there is an Irish statute in some respects corresponding to it (16 and 17 Vict. c. 38). In Scotland, the trees of an orchard fall under the act for preserving planting (1698, c. 16), and several still earlier enactments; and the breaking of orchards is an offense punishable by the sheriff (Ersk. i. 4, 4). See ORCHARD PLANTATION. Injuries done to trees or other fruits of the soil are punishable at common law, independently of all statutory provisions, as malicious mischief, both in England and in Scotland.

FRUIT-TRADE. The trade in fruit is divided into two distinct branches—the *fresh* and the *dried* fruits. Fresh fruits, such as those which grow abundantly in England, are sold for London consumption almost entirely at Covent garden market; the sales at the borough and other metropolitan markets being comparatively small. There are many fruit-gardens within 20 m. of the metropolis which depend almost wholly on London consumption; but since the extensive spread of railway accommodation, fruit can now be brought up from distant parts of England with great felicity; and provincial towns and the metropolis can alike be well supplied. Rapid conveyance and prompt sale and delivery are essential conditions to this kind of trade, owing to the tendency of the fruit to spoil by keeping. The higher the quality of the fruit, the more certain is the sale in London. There are in the island of Jersey pear-orchards, the produce of which is contracted for at very high prices by some of the Covent garden dealers. The orange and lemon trades are managed in rather a peculiar manner; the produce is brought to England in very swift vessels, and is mostly consigned to fruit merchants in the neighborhood of Lower Thames street, who sell it to the fruiterers and the street-dealers, as well as to the markets.

Dried fruit comprises raisins, currants, figs, and the like. Grown and dried in foreign countries, chiefly bordering on the Mediterranean, these kinds of fruit mostly arrive in cases and casks; and the dealings connected with them are conducted much in the same way as those with what is called colonial produce, such as grocery.

Of raisins, currants, oranges, and lemons, the quantity and value imported into the United Kingdom in 1875 were as follows:

Raisins, 551,504 cwt.	£1,040,648
Currants, 1,062,811 cwt.	1,412,357
Oranges and lemons, 2,861,719 bushels	1,336,247

We present the numbers for one year, but it was a year of more than average activity in this branch of trade. Of other kinds of fruit, the official tables present the following quantities, in round numbers, in one average year—Almonds, 34,744 cwt.; apples, 385,046 bushels; figs, 46,040 cwt.; grapes, 19,557 bushels; chestnuts, 57,048 bushels; cocoa-nuts, 2,484,423 no.; hazel-nuts, 220,386 bushels; walnuts, 68,363 bushels; pears, 61,055 bushels; plums (French), 8,702 cwt.; prunes, 16,030 cwt.; tamarinds, 634,697 lbs.

Some years ago, statistical papers in the *Morning Chronicle* gave returns concerning the quantity of fruit sold in Covent Garden and other London markets annually, estimated in the usual way by bushels, cwts., pottles, etc. About the same period, Mr. Braithwaite Poole, goods-manager on the London and North-western railway, gave tables of the amount, estimated in tons, of the fruit brought to London generally. The sources of information are not very clearly stated in either case; and as the two accounts are inconsistent ones with another, they need not be given here.

FRUMEN'TIUS, SAINT, Apostle of Ethiopia and the Abyssinians, b. in Phenicia towards the beginning of the 4th century. At a very early age, he and another youth, named Œdesius, accompanied their uncle Meropius, a Greek philosopher from Tyre, on a voyage undertaken for mercantile, or, according to others, for scientific purposes. On their return, they landed on the coast of Abyssinia or Ethiopia, to procure fresh water; but the savage inhabitants, under the pretext of their hostility with the Romans, made an onslaught upon them, and murdered Meropius and the whole crew, sparing only the two boys, whom they found sitting under a tree and reading. They were taken as slaves into the service of the king; and made themselves so beloved that Œdesius was soon raised to the office of cupbearer, while the more sagacious F. became the king's private secretary and accountant. After the death of the monarch, F. was appointed instructor to the young prince Aizanes, and in this capacity he obtained a still greater influence on the administration of the state affairs. He aided the Christian merchants

who sought these parts, in founding a church, and gradually paved the way for the formal introduction of the new creed. In 326, he went to Alexandria—Œdesius having returned to Tyre, where he was made presbyter—and convinced Athanasius, who had recently been nominated bishop of Alexandria, of the necessity of appointing a special ecclesiastical dignitary for Abyssinia, who should carry out vigorously the work of conversion. Athanasius, in full synod, and with its unanimous approbation, consecrated F. himself bishop of Axum (Auxuma). The new bishop repaired to Abyssinia, and succeeded in proselytizing large numbers. He is also supposed to have translated the Bible into Ethiopian. See ETHIOPIA. On his subsequent theological disputations with Theophilus the Arian—F. himself being in all probability an Athanasian—we cannot enlarge here. F. died about 360, and his day is celebrated by the Latins on Oct. 27, by the Greeks on Nov. 30, and by the Abyssinians on Dec. 18.—Socrates, i. 15; Rufin, *Hist. Eccl.*, i. 9; Theodoret, i. 22; Ludolf, *Hist. Æth.*, iii. 7, 17, etc.

FRUSTUM, in geometry, is the part of a solid next the base, left on cutting off the top by a plane parallel to the base. The F. of a sphere or spheroid, however, is any part of these solids comprised between two circular sections; and the *middle* F. of a sphere is that whose ends are equal circles, having the center of the sphere in the middle of it, and equally distant from both ends.

FRY, ELIZABETH, an eminent female philanthropist and preacher of the society of Friends, third daughter of John Gurney, esq. of Earlham hall, near Norwich, was b. May 21, 1780. Her active and untiring exertions in the cause of suffering humanity, unparalleled in one of her own sex, acquired for her in her lifetime the name of "the female Howard." When not more than 18 years of age, she established a school for 80 poor children in her father's house, with his entire sanction. In 1800, at the age of 20, she married Joseph Fry, esq., of Upton, Essex, then engaged in business in London, to whom she had a family of eight children. In the year 1813, the deplorable condition of the female prisoners in Newgate attracted her attention, and she resolved upon visiting them. Alone and unprotected, she entered the part of the prison where 160 of the most disorderly were immured, and addressed them with a dignity, power, and gentleness which at once fixed their attention. She then read and expounded a portion of Scripture, many of those unhappy beings having on that occasion heard the word of God for the first time. It was not, however, till about Christmas, 1816, that she commenced her systematic visits to Newgate, being then particularly induced thereto by the reports of the gentlemen who, in 1815, originated the "Society for the Improvement of Prison Discipline." She instituted a school within the prison walls, provided work for the females, and the means of Christian instruction, and established a committee of ladies for the reformation of female prisoners. The almost immediate result was order, sobriety, and neatness, in the place of the riot, licentiousness, idleness, and filth, which had previously prevailed. In 1818, her exertions were directed to making provisions for the benefit of female convicts sentenced to transportation. For the relief of females in foreign prisons, she made frequent continental journeys. She also interested herself in the abolition of slavery, the advancement of education, and the distribution of Bibles and tracts. Her labors for the improvement of British seamen, by furnishing the ships of the coast-guard and the royal navy with libraries of religious and instructive books, received the sanction and assistance of government. To the poor and helpless, her charities were unbounded. As a preacher among her own sect, she was held in high estimation; and she often engaged in gospel missions, not only throughout England, Scotland, and Ireland, but to various countries on the continent. She died at Ramsgate, Oct. 12, 1845, aged sixty-five. Soon after her death, a public meeting was held in London, the lord mayor in the chair, for establishing, as the best monument to her memory, "The Elizabeth Fry Refuge," for affording temporary food and shelter to destitute females, on their discharge from metropolitan prisons. Compare *Memoirs of the Life of Elizabeth Fry;* 2 vols. (Lond. 1847), published by her daughters

FRY, JAMES B., b. Ill., 1827; a graduate of West Point, served in the Mexican war, and as instructor in the military academy. In 1861, he was chief of staff to gen. McDowell, sharing in the battle of Bull Run; the next year he was gen. Buell's chief of staff, participating in the battle of Shiloh and other engagements. He was provost-marshal-general, in which position he added 1,120,000 men to the union army, arrested 76,500 deserters, and made a general estimate which showed 2,254,000 men subject to conscription who were not called out. He was promoted to the rank of brevet maj.gen in 1866, and served on the Pacific and in the south.

FRY, WILLIAM HENRY, 1815–64, b. Philadelphia; son of William Fry, proprietor of the *Philadelphia National Gazette.* At a very early age the boy exhibited great musical talent, and meeting, fortunately, with appreciation that secured him a sound musical education. His first orchestral compositions, in 1835, were at once recognized for their power. They consisted of four overtures, and were performed by the Philadelphia Philharmonic society, and obtained for their composer the honorary medal of the society. His first opera was *Leonora.* It was greatly liked and reproduced by the Italian company. He spent six years in Paris, corresponding, during his stay there, with various newspapers in his own country.

Upon his return to New York, he lectured upon the history and science of music,

and composed two symphonies, *The Breaking Heart* and *A Day in the Country*, in illustration of his views.

He composed a Stabat Mater, with vocal as well as orchestral score. He was connected with his father's paper, the *Philadelphia Gazette*, and undertook the editorship of the *Ledger* in 1844. When he settled in New York, he joined the editorial staff of the *Tribune*, a position which he retained until his death.

FRYE, JAMES, 1709–76; b. Mass.; a revolutionary officer who served in the siege of Louisburg, took an active part in the battle of Bunker hill, and commanded the sixth brigade of the army investing Boston.

FRYING. See FOOD AND DRINK.

FRYKEN, small lakes in Sweden in three main bodies and connected by narrow channels, the whole forming an irregular river. They are situated in the Frykedal, n.w. of lake Wenner.

FRYXELL, ANDERS, a Swedish historian, was b. in 1795, at Hesselskog, in Dalsland; studied at Upsala; took priest's orders in 1820; and in 1828, became rector of St. Mary's school, Stockholm. He afterwards became provost of North Vermland, but resigned this post in 1847. F. first required a reputation by his *Berättelser ur Svenska Historien* (Narratives from Swedish History, vols. i.–xviii., Stockh. 1832–52). These narratives, strung together on something of the same plan as sir Walter Scott's *Tales of a Grandfather*, are marked not only by their patriotic sentiment, but by their fresh and natural conception, their richness of biographic detail, their naive and vivacious execution, and soon obtained a wide popularity in Sweden. The first volumes of this truly national work have been repeatedly published, and have been translated into almost all European languages; for example, into English by Schoultz (1844), and into German by Homberg (1843). The part devoted to the history of Gustavus Adolphus has also been translated into German by Homberg (1842–43), into French by Mlle. N. du Puget (1839), and into Dutch by Radijs (Utrecht, 1844); and that devoted to the history of Gustavus Vasa into German by Ekendahl (1831). F.'s *Characteristics of the Period from* 1592 *to* 1600 *in Sweden* obtained a prize offered by the Swedish academy. Another work, entitled *Om Aristokrat-fördömandet i Svenska Historien* (4 vols., Upsala, 1845–50), in which he endeavors to clear the Swedish aristocracy from the accusations urged against them by Geijer and others, involved him in a keen controversy with the democratic liberal party in Sweden. F. has also addicted himself to poetry and music; and an opera of his, called *Vermland's Flickan* (or "The Lass of Vermland"), has proved very attractive to his countrymen, on account of its fine national melodies.

FUACAM ET FLAGELLUM (gallows and whip), in feudalism, the lowest of all servile tenures, in which the bondman was entirely at the lord's mercy both in limb and life.

FUAD-MEHMED, Pasha, a Turkish statesman and litterateur, was b. at Constantinople in 1814. He was the son of the celebrated poet, Izzet-Effendi-Kitchegizadé, better known under the name of Izzet-Mollah, and nephew of Leïla Khatun, one of the very few Turkish poetesses. Having received an education more literary than that of the majority of young men destined for public affairs in Turkey, he began to make himself known as an author, when the exile of his father, who had fallen into disgrace with the sultan Mahmud, and the confiscation of the paternal property, compelled him to choose a profession. He betook himself to medicine, and studied at Galata-Sérai from 1828 to 1832. In 1834, he was appointed admiralty physician, and accompanied the grand admiral in his expedition against Tripoli; but on his return to Constantinople, he abruptly forsook medicine, and entered the more unquiet arena of politics. For several years he employed himself in the study of diplomacy, history, modern languages, the rights of nations, and political economy. In 1840, he became first secretary to the Turkish embassy at London, where his skill and sagacity first made themselves conspicuous. In 1843, he was named second dragoman of the sublime porte, and shortly after was chosen to proceed to Spain to felicitate the queen of that country on her accession to the throne. Fuad-Mehmed was very popular at the court of Madrid. It was almost impossible to believe him to be a Turk. He spoke French marvelously well, made *bon-mots* like Talleyrand, and showed himself as gallant as an Abencerrage. Curiously enough, although a *Mohammedan*, he obtained, while in Spain, among other honors, the grand cord of Isabella the *Catholic*. Here also he composed a poem on the Alhambra, which Turkish critics praise highly for its novel and interesting reflections. On his return to Constantinople, he was appointed to discharge the functions of grand interpreter to the porte, which brought him into contact with the duke of Montpensier, who arrived at Constantinople in 1845, and who, on his return to France, invested him with the cross of commander of the legion of honor. In 1850, he went on a mission to St. Petersburg, and in 1853, on another to Egypt. On his return from the first of these, he became minister of foreign affairs under the grand viziership of Aali Pasha (Aug., 1852). On the question of the "Holy Places," Fuad-Mehmed, by his attitude, and by a brochure very hostile to the pretensions of Russia, entitled *La Vérité sur la Question des Lieux Saints*, gave great dissatisfaction to the czar. In 1854, Fuad-Mehmed went to Epirus along with Omar Pasha, acting sometimes as a diplomatist and sometimes as a

general. In the following year he received the title of pasha, and was again appointed minister of foreign affairs. From 1861 to 1866, he held the office of grand vizier. He died in 169. To him especially it is said Turkey owes the hatti-sherif of 1856, ordering the consolidation of the external defenses of the porte and the institution of telegraphs and light-houses.

When the Turkish academy of science and belles-lettres was established in 1851, Fuad-Mehmed was one of the first members, and in the following year he published a *Turkish Grammar*, which is highly esteemed by native scholars. He was loaded with distinctions by European sovereigns.

FUCA, STRAIT OF, a passage separating Washington territory in the United States from Vancouver's island, and connecting the Pacific ocean with the gulf of Georgia, has its outer or western entrance in lat. 48° 10′ n., and long. 124° west. It contains several islands, one of which, San Juan, became, in 1859, the subject of a dispute between Great Britain and the United States; the question being, whether it was to be regarded as an appendage of Washington territory or British Columbia. The question was submitted in 1872, to the emperor of Germany as arbiter; and he decided that the line of boundary should be run through the strait of Haro, west of San Juan, thus awarding that island to the United States.

FUCA'CEÆ, according to Lindley, a natural order of acotyledonous plants; but more generally regarded by botanists as a suborder of *algæ*. The species are numerous, about 500 being known, mostly growing in salt water. They are distinguished from the other algæ by their organs of reproduction, which consist of spores and antheridia, contained in common chambers or conceptacles, which are united in club-shaped receptacles at the end or margins of the fronds. The antheridia contain phytozoa. The frond is sometimes a stalk expanding into a broad blade, and sometimes exhibits no such expansion, and is either simple or variously branched. Many of the F. are provided with vesicles containing air, by the aid of which they are enabled to float in the water. Some attain a great size—*macrocystis pyrifera* is said to have fronds of 500 to 1500 ft. in length; its stem not being thicker than the finger, and the upper branches as slender as pack-thread. Most of the F. contain iodine in very considerable quantity, and some of them are therefore much used for the manufacture of kelp (q.v.), particularly different species of *fucus*, or wrack, and *laminaria*, or tangle. On account of the soda which they contain, they are also valuable as manure. Some of them are eatable, containing large quantities of gelatinous matter, as the Dulse (q.v.), tangle (q.v), and badderlocks (q.v.) of the British coasts, and certain species of *sargassum* in other parts of the world. The medicinal uses of some of them seem to depend upon the iodine which they contain, and which it is now considered preferable to exhibit in other forms, after it has been extracted.

FU-CHOW-FOO (Happy City), a city and port of China, and capital of the province of Fuh-keen. It is beautifully situated on the left bank of the Min, 25 m. distant from the mouth of that river, in lat. 26° 3′ n., long. about 119° 50′ e., and was opened to foreign commerce by the treaty of 1842. The walls of the city are about 30 ft. in height, and 6 m. in circumference, and have seven gates, the gateways of which are constructed of bricks, resting on a foundation of granite. The bridge of forty or fifty arches over the river Min, is 12 ft. wide, and about 1200 ft. long. A Buddhist monastery on Wu-shi-shan has been converted into the city residence of the British consul. The lacquered ware of F. is of special excellence, and the method of preparing it is known only to one family, by whom the secret is jealously kept. The exports during the season 1874–75 amounted to 96,497,717 lbs. of tea, of which about two thirds went to Great Britain. Its total exports in 1875 amounted to £4,121,496; imports to £1,512,464. The number of ships which cleared the port, 248; tonnage, 168,088: ships entered, 251; tonnage, 169,518. The chief imports are lead, cotton, woolen goods, and opium. The duties on foreign trade are greater in amount than those received at any port in China except Shanghai. The population of the city has been estimated at 500,000.

FUCHS, JOHANN NEPOMUK VON, 1774–1856; a German mineralogist and chemist, studying in Freiberg, Berlin, and Paris. In 1807, he was professor of those sciences in the university of Landshut, and in 1823 conservator of the mineralogical collections at Munich, where he was made professor of mineralogy. He retired from public life in 1852, and was ennobled in 1854. He is known for his discovery, in 1823, of a process for making a soluble glass used for fixing fresco colors, according to the method called stereochromy.

FUCHS, or FUCHSIUS, LEONHARD VON, 1501–66; a German physician, one of the fathers of scientific botany. In his tenth year he was sent to school at Heilbronn, whence, a twelvemonth later, he was removed to Erfurt. After a year and a half, he was admitted a student of the university of that town, which in 1521 conferred on him the degree of baccalaureus. During the next 18 months, he gave lessons in Latin and literature in his native town. He then repaired to the university of Anspach, where, in 1524, he was created a master of arts. About the same time, he espoused the doctrines of the reformation. Having in 1524 received the diploma as doctor of medicine, he

practiced for two years in Munich. He became, in 1526, professor of medicine at Ingolstadt, and in 1528 physician to the margrave of Anspach. In Anspach he was the means of saving the lives of many during the epidemic locally known as the "English sweating-sickness." By the duke of Würtemberg he was, in 1535, appointed to the professorship of medicine at the university of Tübingen, a post held by him till his death. F. was an advocate of the Galenic school of medicine, and published several Latin translations of treatises by its founder and by Hippocrates, besides controversial tracts against the opinions of H. Thriverius, G. Ryffius, C. Egenolphus, G. Rufinus, G. Puteanus, and S. Montius.

FUCHSIA, a genus of plants of the natural order *onagraceæ*, containing a large number of species, natives of South America and of the southern parts of North America. They are half-shrubby plants, shrubs, sometimes climbers, and small trees, and have generally pendulous red flowers; of which the calyx is funnel-shaped, 4-cleft, finely colored; the corolla 4-petaled; the fruit is a 4-celled berry; the leaves are opposite; the flower-stalks 1-flowered, springing from the axils of the leaves, or sometimes forming racemes at the top of the branches. Some of the species, as *F. coccinea*, *F. gracilis*, *F. globosa*, *F. fulgens*, *F. macrostemon*, *F. longiflora*, are much cultivated in gardens and greenhouses for the beauty of their flowers. Most of the species are too delicate for the climate, at least of the northern parts of Britain; but some of them, although killed to the ground every winter by frost, spring again from the root, and flower beautifully in autumn. A little protection around the root is of great use in preserving them in vigor. All of them are propagated with extreme facility by cuttings, which has no doubt contributed to their present abundance, even in the gardens and windows of the poor. No flowering shrubs of recent introduction into Britain have become nearly so popular as those of this genus; and new varieties and hybrids have been produced in vast numbers, of which those with white flowers are particularly prized. The berries of a number of the species are eaten in South America, and preserved with sugar; and they are occasionally used in both these ways in Britain, although in Scotland the fruit even of the most hardy ripens only in favorable situations, for the most part on the west coast. Where the climate admits of it, a F. hedge is extremely ornamental. The wood of some species is employed in their native-regions for dyeing black. The genus is named in honor of Leonhard Fuchs, one of the fathers of modern botany, born in Swabia in 1501, died at Tübingen, where he was a professor, in 1565.

FUCHS'S SOLUBLE GLASS is a peculiar silicate, which is prepared by melting together 8 parts of carbonate of soda, or 10 parts of carbonate of potash, with 15 of pure quartz sand, and 1 part of charcoal, which is added to facilitate the decomposition of the alkaline carbonate. A black glass is thus obtained, which is not soluble in cold water, but dissolves in about six times its weight of boiling water. Fuchs commenced his experiments on this subject in 1825, and has continued and varied them ever since. The above is, however, we believe, the most approved formula. The practical uses of the soluble glass to which he especially directed his attention were two—viz. (1), as a varnish, which, applied in the fluid form to stone surfaces, would harden into a glass, and prevent the ordinary effects of atmospheric influences; and (2) as a means of fixing fresco colors by the process known as stereochromy. At the request of the late prince consort, Dr. Fuchs gave a summary of all that he had done in this department in a paper which he read before the society of arts in 1859. See FRESCO.

It may be mentioned that prof. Kuhlmann of Lille has been long working at the same subject; and in 1857, published his method of producing a stone-protecting silicate; and that our own countryman, Mr. Ransome of Ipswich, has not only employed concentrated solutions of silicate of potash, or of soda, as a cement for consolidating silicious sand into a very hard, durable, artificial sandstone, capable, before it is fired, of being molded into any desired form, but has likewise produced a vitreous varnish, consisting of silicate of potash, after which he applies a coating of a solution of chloride of calcium: a silicate of lime is thus formed, which is stated to be very successful in protecting the surface of stone from external influence. Wood that has been painted with these varieties of soluble glass is rendered nearly if not quite fire-proof.

FUCI'NO, LAKE OF, or LAGO DI CELANO (ancient *Fucinus Lacus*), a lake of Italy, in the province of Abruzzo Ultra II. remarkable as the only one of any extent found in the central Apennines. It is 10 m. long by 7 broad; and is situated at an elevation of 2,176 ft. above the sea-level. It is subject to sudden risings; and in ancient times, by order of the emperor Claudius, a magnificent subterranean channel more than 3 m. in length, to carry off the surplus water, was cut partly through the solid rock of monte Salviano, rising 1000 ft. above. This tunnel became obstructed in the middle ages, and long remained so, notwithstanding many attempts to clear it. In recent times the surrounding country has been often submerged. In 1855, operations were commenced for the restoration of the Claudian aqueduct, and on the Aug. 9, 1862, the work was completed. Down till 1871, about £20,000,000 were expended upon the drainage of this lake.

FUCUS. See FUCACEÆ and WRACK.

FUEL. This term is generally applied to combustibles used for the production of heat: also, less frequently, to combustibles such as oil, paraffine-oil (q. v.), used for lighting. Under articles COAL, COKE, etc., will be found details of the physical properties and chemical composition of the various fuels; the following observations bear chiefly on their economical application as sources of motive power.

The two elementary bodies to which we owe the heating powers of all our fuels, natural and artificial, are carbon and hydrogen. Coke, wood-charcoal, peat-charcoal, and anthracite, contain little or none of the latter element, and may be regarded as purely carbonaceous fuels. But wood, peat, and most varieties of coal, contain hydrogen as well as carbon; and in their combustion, these two substances combine to produce volatile and combustible hydrocarbons, which are volatilized previous to being consumed, while a purely carbonaceous F. evolves no volatile matter until combustion has been effected.

These hydrocarbons are numerous and varied in composition (see CARBOHYDROGENS); but when combustion is perfect, the amount of heat produced by any hydrocarbon is exactly what would have been produced had the hydrogen and carbon been burned separately. It will be of advantage, therefore, to study these two elementary combustibles in succession, in order to estimate subsequently the combined effect where they come together in the same fuel.

The heating power of a combustible, or the *amount* of heat generated by it, is usually expressed in degrees Fahrenheit on so many pounds' weight of water. But in estimating the *temperature*, or intensity of heat produced, we have to keep in view that different substances have different capacities for heat—that of water being generally assumed as unity. The number expressing this capacity is called the specific heat of the substance. Water 1000, carbonic acid 221, imply that while 1000 units of heat are required to elevate the temperature of water any given number of degrees, only 221 units are required to elevate to the same temperature an equal weight of carbonic acid.

CARBON AS FUEL.—1. *Amount of air required for combustion.*—Burned in air, carbon combines with the oxygen to form carbonic acid (CO_2), mingled with nitrogen, the other atmospheric element. The chemical change may be thus represented, atomically:

			PRODUCTS OF COMBUSTION.	
Carbon,		6.0		
Air (69.6)	Oxygen,	16.0	Carbonic acid,	22.0
	Nitrogen,	53.6	Nitrogen,	53.6
		75.6		75.6

Or, assuming carbon as unity:

Carbon,		1.000		
Air (11.6)	Oxygen,	2.667	Carbonic acid,	3.667
	Nitrogen,	8.933	Nitrogen,	8.933
		12.600		12.600

Carbon, therefore, requires about twelve times its own weight of air for perfect combustion.

2. *Amount of heat produced.*—Andrews found that 1 lb. carbon produced heat equal to 1° F. in 14,220 lbs. of water. Other observations agree very closely. This may be otherwise stated thus: 1 lb. carbon will raise from freezing to boiling point (32° to 212° = 180°) $\frac{14220}{180}$ = 79 lbs. water; from mean temperature to boiling-point (60° to 212 = 152°) $\frac{14220}{152}$ = 93.5 lbs. water; will boil off in steam from mean temperature (60° to 212° = 152°, add latent heat in steam, 965° = 1117°), $\frac{14220}{1117}$ = 12.73 lbs. water; and will boil off in steam from boiling-point (latent heat in steam 965°) $\frac{14220}{965}$ = 14.74 pounds.

3. *Utmost Temperature or Intensity of Heat from Carbon.*—Here we suppose the combustion effected in a space inclosed by non-conducting material, so that all the heat produced by 1 lb. carbon is retained by the products of its combustion. Caloric sufficient to raise 14,220 lbs. water 1° F. is thus compressed, as it were, into 12.6 lbs. of carbonic acid and nitrogen. To determine the temperature thus produced, we require to know the specific heat of this gaseous compound, that of water being 1.

3.667 lbs. carbonic acid.	Specific heat	.2210
8.933 " nitrogen.	" "	.2754
12.600 " products of combustion.	Mean sp. "	.2596

14,220° on water at 1.000 specific heat, will give 54,776° on these products per pound-weight. Distributed over 12.6 lbs., this heat will raise the temperature to $\frac{54776}{12.6}$ = 4347°

F., which is therefore the utmost intensity of heat attainable in burning carbon, supposing no loss by absorption or radiation.

4. *Effect of Excess of Air.*—Excess of air has been proved to have no effect on the *quantity* of heat produced where combustion is perfect; but the intensity of *temperature* is diminished. Suppose two equivalents of air admitted; we then have as the products of combustion—

3.667 lbs.	carbonic acid.	Specific heat	.2310
8.933 "	nitrogen.	" "	.2754
11.600 "	air in excess.	" "	.2669
24.200 "	products.	Mean sp. "	.2631

14,220° on water = 54,048° on this new mixture of gases. But the heat is now diffused over 24.2 lbs. matter instead of 12.6 lbs., $\frac{54048}{24.2} = 2347°$ F.: the utmost temperature produced by carbon burned in two equivalents of air.

The utmost temperatures attainable, with various proportions of air, are given below, and also the appearance which the interior of the furnace would exhibit. Flame at these temperatures will present the same differences in color.

Weight.		Ratio of Fuel to Air.	Highest Possible Temperature.	Appearance of a Body exposed to such Temperature.
Carbon.	Air.			
lbs.	lbs.			
1.	11.6	1 to 1	4347°	Intensely brilliant.
1.	17.4	1 " 1½	2951	Dazzling white.
1.	23.2	1 " 2	2233	Bright ignition.
1.	29.0	1 " 2½	1797	Full cherry red.
1.	34.8	1 " 3	1503	Commencing cherry red.
1.	58.	1 " 5	906	Incipient red.
1.	69.6	1 " 6	758	Black.

5. *Effect of Deficiency of Air.*—If, before reaching the upper layers of carbon or cinder, the air has parted with all its oxygen to form carbonic acid with the production of heat, then the carbonic acid combines with part of the remaining carbon to form carbonic oxide, CO (q.v.), but without producing heat. The loss may amount, therefore, to one half of the F.: some have stated it as high as three fourths. If this oxide, when it gets above the F., meet with air before cooling, it burns with a pale blue flame, restoring part of the lost heat; but to what extent has not yet been determined.

6. *Effect of Water Present.*—Passing into vapor, water absorbs both sensible and latent heat, and thus diminishes the temperature. Heating power is also lost, as products of combustion are generally passed into the atmosphere at a high temperature.

HYDROGEN AS FUEL.—1. *Air required.*—Hydrogen combines with the oxygen of the air to form vapor of water, mingled with nitrogen:

				Products of Combustion.	
Hydrogen,		1.			
Air (34.8)	Oxygen,	8.	→	Vapor of water,	9.
	Nitrogen,	26.8		Nitrogen,	26.8
		35.8			35.8

1 lb. hydrogen therefore requires 34.8 lbs. air, while 1 lb. carbon requires only 11.6 lbs.

2. *Amount of Heat Produced.*—The amount of heat produced from hydrogen is much greater than that from carbon; the caloric from 1 lb. heating 60,840 lbs. water 1° F. Part of this is, however, latent in the water-vapor, and must be deducted in calculating intensity of heat, and also heating effect under all ordinary circumstances. This deduction amounts to 9 lbs. water × 965° latent = 8685°, leaving 52,155° as the effective heating power of 1 lb. hydrogen.

3. *Utmost Temperature or Intensity of Heat.*—This is *less* than in the case of carbon, from the high specific heat and greater quantity of the products. We have—

Vapor of water	9. lbs.	Specific heat	.8470
Nitrogen	26.8 "	" "	.2754
	35.8 "	Mean sp. "	.4191

52,155° on water will be 124,445° on these products; and $\frac{124445}{35.8}$ lbs. = 3476°, is the utmost possible temperature.

4. *Effect of Excess of Air.*—As in the case of carbon, the intensity of heat is diminished, as under:

Weight.		Ratio of Fuel to Air.	Highest Possible Temperature.
Hydrogen.	Air.		
lbs.	lbs.		
1.	34.8	1 to 1	3476°
1.	69.6	1 " 2	2187
1.	104.4	1 " 3	1591
1.	139.2	1 " 4	1250

5. *Effect of Deficiency of Air.*—No new product is the result of deficiency of air, as in combustion of carbon; the hydrogen simply escapes unconsumed.

6. *Effect of water-vapor present* is diminution of intensity and ultimate loss of heat in application, as in the case of carbon.

Temperature of Ignition of Carbon and Hydrogen.—These substances must be themselves heated before they can burn. Hydrogen begins to burn at or below 300°, while carbon requires a red heat (800° to 1000° F.), and even at that temperature burns very slowly. Consequently, where they are combined, as in common coal, the temperature present is often sufficiently high to ignite and consume the hydrogen, while the carbon remains unchanged as cinder, or passes away as smoke, unconsumed in either case.

All that has been said above of carbon, as to air required, heating power or value, utmost temperature, temperature of ignition, effect of water present, and of excess or deficiency of air, applies, without modification, to one class of fuels—the purely carbonaceous, including anthracite, coke from coal, charcoal from wood and peat, and the cinder of any description of fuel. The incombustible ash must be allowed for in calculating heating power or value; and also the volatile bodies—nitrogen, sulphur, etc.—the latter of which frequently renders the F. unsuitable for many purposes in the arts and manufactures.

Peat, wood, and coal, with the exception of anthracite, contain hydrogen to an extent rarely exceeding 5 per cent. We have seen that, compared with carbon, hydrogen requires three times as much air, and generates nearly four times as much heat, but produces 20 per cent less intensity of heat, and ignites at a much lower temperature; and the combustion of wood, coal, etc., is in these respects modified according to the proportion of hydrogen present in them.

The following table shows the composition of British coal, as determined by Playfair and De la Beche. Columns 8 to 12 are added to illustrate the process of combustion.

LOCALITY.	Average Composition.					On Distillation, there is						Proportion of Hydrogen to Carbon.
						Left as Coke or Cinder.		Expelled in Gaseous Form.				
								Water, Sulphur, and Nitrogen.	As Volatile Hydrocarbons.			
	Carbon.	Hydrogen.	Water — Hydrogen and Oxygen.	Sulphur and Nitrogen.	Incombustible Ash.	Ash.	Carbon.		Hydrogen.	Carbon.	Total.	
Wales........	83.78	4.27	4.67	2.41	4.91	4.91	67.69	6.68	4.27	16.09	20.36	1 to 3.
Newcastle...	82.12	4.60	6.40	2.59	3.77	3.77	56.90	8.99	4.60	25.22	29 82	1 " 5.5
Lancashire..	77.90	4.53	10.72	2.74	4.88	4.88	55.34	13.46	4.53	22.56	26.69	1 " 5.4
Scotland.....	78.53	4.40	10.90	2.11	4.03	4.03	50.19	13.01	4.40	28.34	32 74	1 " 6.4
Derbyshire..	79.68	3.66	11.56	2.42	2.65	2.65	56 67	13.98	3.66	23.01	26.67	1 " 6.3
	1	2	3	4	5	6	7	8	9	10	11	12

When coal is heated in a retort, it yields volatile hydrocarbons (q.v.), amounting to 20 to 32 per cent of its weight (see column 11). The hydrogen has robbed the F. of six times its own weight of carbon. When fresh F. is added to live coal in a furnace, the same result ensues; so that in using coal, 50 to 67 per cent of carbon burn on the grate, and 20 to 32 per cent carbon and hydrogen have to be burned in the open space above the F., or escape unconsumed.

The elements of a hydrocarbon are consumed, not simultaneously, but in succession. First, the carbon is separated from the hydrogen in light floating particles, subsequently seen as soot or smoke (if not consumed); then the hydrogen burns, and communicates heat to the carbon particles, which then appear as flame. The color of the flame indicates the temperature present; and if the temperature is sufficiently high, the carbon of which the flame is composed burns also, producing a further increase of heat. If not, the flame, as it moves onward, cools, becoming red, dull red, and finally black and

smoky, passing away as such. For complete combustion of common coal, we therefore require not only air in sufficient quantity, but also intensity of heat above the fuel. We require a low temperature to separate the carbon from the hydrogen; a higher temperature to consume the hydrogen; and a still higher to consume the carbon of the flame. In closed furnaces, such as those of steam-boilers, while the current of air supplied continues pretty uniform in quantity, the volatile bodies are evolved almost immediately after fueling; and would require, for the moment, perhaps four times the quantity of air which is passing through. The volatile F. is, in consequence of the want of air, carried off partly unconsumed; and the temperature in such furnaces is frequently too low for the ignition of carbon, as may be seen from the color of the flame; the cold boiler having abstracted the heat before the flame has been subjected to its influence. We refer to the article SMOKE, CONSUMPTION OF, for an account of the plans which have been adopted to secure perfect combustion, and thus prevent smoke. From the principles involved, we should expect most success where the F. is supplied by mechanical arrangements as regularly and uniformly as the air, and where, in addition, the body of the furnace is protected or removed so far from boiler-surface and other cooling agents as is necessary to maintain a temperature within it sufficient for the thorough ignition of the flame. In house-fires, where the heat is lost if not radiated forward into the room, the cinders should be drawn to the front, and the fresh F. laid into the vacant space behind. The gases rise between the two, and being highly heated, form a sheet of flame above and behind the red-hot F. in front. If, as is commonly done, we throw the fresh F. on the top of the live coal, we interrupt the process of radiation, and the gaseous part of the F. is thrown off rapidly into the cool atmosphere above the grate, and does not take fire until a considerable period has elapsed. To our ordinary fire utensils, we might with advantage add one of a rake shape, suited for drawing forward the fuel.

For dimensions of furnaces, etc., see STEAM-ENGINE.

Economy of F. will be best secured, first, by accomplishing perfect combustion both of the fixed and volatile parts of the F.; and secondly, by regulating the amount of air, as any excess of this has to be passed on to the chimney at the same high temperature as the true products of combustion.

The abundance or scarcity of food has a great effect on the general interests of a country and the comfort of its inhabitants. The wealth and prosperity of Britain must be attributed in no small degree to the abundance of coal in those districts both of England and Scotland in which ironstone is most abundant, and in which, therefore, the coal is required as F. for smelting it. But even for the most ordinary uses of domestic economy, the scarcity of F. in some parts of the world causes much hardship to their inhabitants, whilst its abundance in others is one of their greatest natural advantages. Coal, wood, and peat are the three kinds of F. principally used; coal being indeed the vegetation of former ages—or rather of former geological periods—the product of their sunshine and their showers, treasured up for the present; peat, a recent formation. Coal may be said in general to be of about twice the the value of wood as F., weight for weight, in its heating power. In those parts of the world in which coal is not found, or to which it cannot be easily—or as yet profitably—conveyed, the preservation of forests is of great importance, and trees are not unfrequently planted, as in some parts of Europe, in hedgerows and otherwise, chiefly in order to provide a supply of fuel. For the same reason, pollarding is resorted to, the branches being used as F., and the trunk left to produce new branches. Only some kinds of trees are adapted to this mode of treatment. In some regions, as on some of the steppes of Asia and other treeless plains, the dried dung of herbivorous animals is much used as fuel. In cases of less extreme necessity, all kinds of vegetable refuse are used. Thus, in many parts of the continent of Europe, things are carefully gathered up for F. which in any part of Britain would most probably be burned on the field, to get them out of the way. But it is not easy to compute the benefit derived by many parts even of Britain, particularly the inland parts, from the recent great increase of the facilities of communication and of the trade in coal.

FUENTÉ ALA'MO, a t. of Spain, in the province of Murcia, 18 m. s. from Murcia, at the northern base of a range of hills, and at a short distance from the canal of Murcia. Pop. 6,250.

FUENTE DE OVEJUNA (the Sheep-well), a small walled town of Spain, in the province of Cordova, and 44 m. n.w. of the town of that name, is situated on the crest and sides of a conical hill, between two of the upper branches of the Guadiata. At the foot of the hill, and on its western side, are the wells from which this town has derived its name. It has manufactures of linens, woolens, and leather. Coal seams occur in the vicinity. Pop. about 5,500.

FUENTERRABI'A, or FONTARABRA, an ancient t. and frontier fortress of Spain, in the province of Guipúzcoa and bishopric of Pamplona, 11 m. e.n.e. of San Sebastian, and 2 m. from Irun; pop. 772. It stands on the slope of a hill on the w. bank of the Bidassoa, and near the point where its estuary begins. Though now much decayed, it formerly possessed considerable strategic importance, and it has frequently been taken and retaken in the wars between France and Spain. The "dolorous rout" of

Charlemagne, however, which has been associated by Milton with F., is generally understood to have taken place not here, but at Roncesvalles, which is nearly 40 m. distant. Unsuccessful attempts to seize F. were made by the French troops in 1476, and again in 1503. In a subsequent campaign (1521) these were more successful, but it was retaken in 1524. The prince of Conde sustained a severe repulse under its walls in 1638, and it was on this occasion that the town received from Philip IV. the rank of city. After a severe siege it surrendered to the duke of Berwick in the English war of 1719, and in 1794 it again fell into the hands of the French, who so dismantled it that it has never since been reckoned by the Spaniards among their fortified places. It was by the ford opposite F. that the duke of Wellington, on Oct. 8, 1813, by "one of the most daring exploits of military genius," successfully forced a passage into France in the face of an opposing army commanded by Soult. Severe fighting also took place here during the Carlist war in 1837.

FUEN'TES DE ONORO (The Fountains of Honor), a small village of Salamanca, Spain, on the Portuguese frontier, 14 m. w. of Ciudad Rodrigo, is well known as the scene of one of the important battles of the peninsular war, between the English under Wellington and the French under Massena. Wellington, who had resolved to abide battle, drew up his forces between the Coa and the Agueda, his line extending n. and s. for about 7 m., and his right wing stretching 2 m. s. of F. de Onoro. On the 3d May, 1811, this village was fiercely attacked by a strong body of French troops, who forced the English from the streets, and were not dislodged until the English, reinforced by three regiments, drove them by a terrific charge from their position, with a loss in all of 300 men. On the 5th, the battle proper commenced. The French, much stronger than their enemies both in cavalry and infantry, assailed Wellington's right with overwhelming numbers, and although prodigies of valor were performed by the English—as in the case of Ramsey's brigade of horse-artillery, which cut its way through a solid body of cavalry—their right wing was turned, and their position lost. Never during the war were the English forces more perilously situated. Meanwhile, at F. de O., on which Wellington's *left* wing now rested, a fierce battle was being fought. The three English regiments who had been left in occupation made a desperate resistance against assailing multitudes. The fight lasted here till evening, reinforcements having been brought up on both sides; and the night closed upon the English holding the crags above the town, and the retiring regiments of the French. The loss of the allies amounted to 1500, while that of the French was stated at the time to be nearly 5,000, and was certainly greater than that of the allies. Neither army could claim a decided advantage in this battle; but its result was, that on the 10th, the French were forced across the Portuguese frontier; and thus ended the French invasion of Portugal.

FU'ERO, a Spanish word derived from Lat. *forum*, signifies strictly the seat of justice, jurisdiction. In this last sense it was transferred to collections of laws, and specially to the civic rights granted by the kings to individual cities, the most famous of which were the F. of Leon and that of Naxera. As these city charters contained for the most part special liberties, concessions, and privileges, the word F. became current chiefly in this sense, and was particularly so applied to designate the body of privileges and liberties that made up the constitution of Navarre, and of the three Basque provinces of Biscaya, Alava, and Guipuzcoa. These are the fueros the maintenance of which gave rise to wars in the Basque provinces in 1833. The fueros of other provinces and cities of Spain have been long extinct.

These Basque fueros were grounded on the old laws of the Visigoths, and grew up in the period between the irruption of the Moors into the Spanish peninsula and the consolidation of the Spanish monarchy under the house of Hapsburg. The same was the case in the half-Basque province of Navarre, which formed an independent kingdom under its own sovereigns. The fueros were thus the product of the ancient Gothic laws—those fertile sources of modern rights—and the new circumstances in which they were placed. They resulted by degrees, here as elsewhere, in a struggle between the people and the princes; and their development forms an interesting chapter in the history of modern constitutionalism. They were at first only privileges and statutory rights granted to single places, and from these were extended to others. By the introduction of the representative element of the cortes, and extension over whole provinces, they were then transformed, in virtue of the general law of custom, into constitutional rights of these provinces, and were in time collected and formally embodied and sanctioned as such. It was in this way that the fueros of Navarre, which had been growing into consistency for centuries previously, were, in 1236, during the contests between king Theobald and his cortes, collected and recorded, and remain yet under the title of *Cartulario del Rey Tibaldo.* Ferdinand the Catholic, who united Navarre with the crown of Castile, maintained the fueros, adapting them to the new relation to Castile. Their leading provisions were these: The cortes, chosen for three years, and consisting of the three estates of clergy, nobles, and commons, are to meet yearly; and without their consent no law can be passed, or anything of importance undertaken. The government consists of the viceroy, who presides in the cortes and great council; the great council of Navarre (a body similar to the old French parliaments); and the contaduria, before which all accounts of revenue and expenditure must be laid. There is no custom-house

or toll but at the frontier, and except the trifling grant of 176,000 reals, nothing flows into the royal treasury. All these fueros the king had to bind himself by a royal oath to maintain.

In the lordship (señorio) of Biscaya, the fueros grew up in the contests of the inhabitants with their counts. They were first collected into a code by count Juan in 1371, which, after the final union of Biscaya with Castile, was recast (1526), completed, and confirmed by king Charles I. (the German emperor Charles V.). According to this charter of rights, every new "lord"—for only so do the Biscayans style the king of Spain as their prince—fourteen years old, must come into the country within a year, and take the oath to uphold the fueros in certain places appointed for that purpose. The government consists of a corregidor, appointed by the "lord," and two deputies; these, aided by six regidores, and forming the regimiento, conduct the administration. But the supreme power resides in the general assembly (junta general), which meets yearly under the tree at Guernica, and regulates all the affairs of the lordship, and appoints the deputies and regidores. Justice is administered, in the first instance, by the lieutenants (tenentes) of the corregidor; in the second, by the corregidor and deputies; and in the third, by the royal court at Valladolid. Other privileges were, that every Biscayan of pure blood was counted noble; that except the post-office there was to be no royal governing board in the province; that Biscayans were not bound to serve in the Spanish army. The fueros of Alava and Guipuzcoa were of analogous origin and character, but differing in details. Abolished by Espartero, these fueros were restored by queen Isabella in 1844. In 1876, a law abolishing the Basque fueros was adopted, and in 1877 a decree was passed assimilating the administration of the Basque provinces to that of Spain.

FUERTE, or VILLA DEL FUERTE, a t. of Mexico, in the province of Sinaloa, 75 m. n. by w. from Sinaloa, on the Rio del Fuerte, which flows into the gulf of California It is a place of some commercial importance. Pop. 8,000.

FUER'TÉ DE ANDALGA'LA, sometimes more briefly called ANDALGALA, a t. of the Argentine confederation, in the province of Catamarca, 72 m. n. by w. from Catamarca, in a mountainous district. Pop. 5,500.

FUERTEVENTU'RA, one of the Canary islands, s. of Lazarote, across the straits of Bacayna; 758 sq.m.; pop. 10,996. Cabras, on the e. coast, has a good harbor.

FUGÆ. See MEDITATIO FUGÆ.

FUG'ARO, the name of a well-known stop of the flute kind in continental organs of 4-ft. pitch, and sometimes of 8-ft. pitch, of a small scale, made of wood or tin; in tone it is as piercing as the *gamba*, but much clearer.

FUGGER, one of the most remarkable families in Germany, which, rising by industry and commerce, has founded numerous lines of counts, and even princes. The ancestor of the family was John F., master-weaver in Graben, near Augsburg. His eldest son, John F., acquired by marriage, in 1370, the freedom of Augsburg, and began to carry on a trade in linen along with weaving. By a second marriage in 1382, with the daughter of a councillor, he had two sons and four daughters. This John F. was one of the council of twelve (Ger. *Die Zwölfer*, "the twelve") in the weaver-guild, and an assessor of the famous Fehmgericht (q.v.) or secret tribunal of Westphalia. He died in 1409, and left what was a large fortune for the time—3,000 guldens or florins.

His eldest son, Andrew F., made such good use of his share of the inheritance, that he got the name of "the rich Fugger." By marriage, he founded a noble line, which, however, died out in 1585. John's second son, Jacob F., who died in 1469, was superior and "twelve" of the weaver-guild, and a man held in high esteem by his fellow-citizens; he was the first of the Fuggers that had a house in Augsburg, and he already carried on an extensive commerce.

Of his seven sons, three, Ulrich, George, and Jacob II., by means of industry, ability, and integrity, extended their business to an extraordinary degree, and laid the foundation for the palmy days of the family. They married into the noblest houses, and were raised by the emperor Maximilian to the rank of nobles. The emperor mortgaged to them, for 70,000 gold guldens, the county of Kirchberg and the lordship of Weissenhorn, and received from them afterwards, through the mediation of pope Julius II., 170,000 ducats, to assist in carrying on the war against Venice. Ulrich F., born 1441, died 1510, devoted himself specially to the commerce that he opened up with Austria, and there was almost no object that did not enter into his speculations; even the masterpieces of Albert Dürer went through his hands to Italy. Jacob F., born 1459, died 1525, engaged in mining; he farmed the mines in Tyrol, and accumulated immense wealth; he lent to the archduke of Austria 150,000 guldens, and built the magnificent castle of Fuggerau, in Tyrol. Thus the wealth of the Fuggers went on increasing. Their wares went to all lands, and scarce a road or sea but bore their wagons or ships.

But it was under Charles V. that the house attained its greatest splendor. Jacob having died childless, and the family of Ulrich being also extinct, the fortunes and splendor of the house rested on the sons of George F., who died in 1506. At his death,

he left three sons, one of whom, Marcus, entered the church; the two younger, Raimund and Antony, carried on the business, and became the founders of the two chief and still flourishing lines of the house of Fugger. The two brothers were zealous Catholics, and with their wealth supported Eck in his opposition to Luther. During the diet held by Charles V. at Augsburg, in 1530, the emperor lived in Antony F.'s splendid house in the wine market. On this occasion, he raised both brothers to the rank of counts, and invested them with the still mortgaged properties of Kirchberg and Weissenhorn; and a letter under the imperial seal conferred on them the rights of princes. For the support they afforded him in his expedition against Algiers in 1535, they received the right of coining money. Antony F., at his death, left six millions gold crowns in ready money, besides jewels and possessions in all parts of Europe and in both Indias. It is of him that the emperor Charles is said to have remarked while being shown the royal treasury in Paris: "There is a linen-weaver in Augsburg that could pay all that out of his own purse."

The emperor Ferdinand II. raised the splendor of the house of F. still higher while confirming the imperial letter of Charles, by conferring great additional privileges on the two oldest of the family, counts John and Jerome. The Fuggers continued still as nobles to carry on their commerce, and further increased their immense wealth. They attained the highest posts in the empire, and several princely houses prided themselves on their alliance with the house of Fugger. They possessed the most extensive libraries and collections of objects of art, maintained painters and musicians, and liberally encouraged art and science. Their houses and gardens were masterpieces of the architecture and taste of the times. There is thus nothing incredible in the story that Antony F., on one occasion when Charles V. was his visitor, lighted a fire of cinnamon wood with the emperor's bond for money lent him.

While thus indulging in splendor, they were not less bent on doing good. Ulrich, George, and Jacob, the sons of the beneficent Jacob, bought houses in one of the suburbs of Augsburg, pulled them down, and built 108 smaller houses, which they let to poor citizens at a low rent. This was the origin of the "Fuggerei," which still remains under the same name, with its own walls and gates. Many other benevolent institutions were set on foot by Antony F. and his sons. It is questionable if we are to rank among their benefactions their calling the Jesuits to Augsburg, and giving them buildings and revenues for a college, church, and school. The race is still continued in the two principal lines of Raimund and Antony, besides collateral branches. The domains are chiefly in Bavaria. A collection of portraits of the most important members of this great house, executed by Domin. Custos of Antwerp, appeared at Augsburg (1593 et seq.). This collection (increased to 127, with genealogies written in Latin) was republished by the brothers Kilian (Augsburg, 1618); and in 1754, a new edition of the work, still further improved, and containing 139 portraits, was published at Ulm, under the title *Pinacotheca Fuggerorum.*

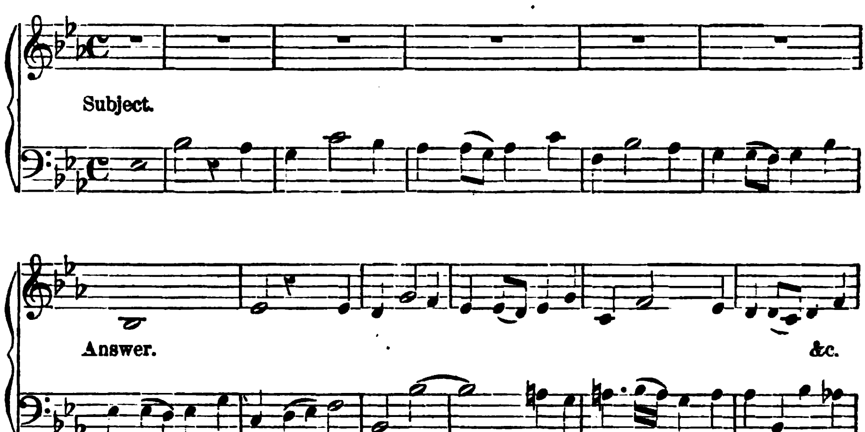
FUGITA'TION. A sentence of F. in Scotland corresponds to outlawry in a criminal process in England, and is pronounced where a person fails to appear to answer to a criminal prosecution against him. Amongst other consequences, it entails the escheat of his whole movable property to the crown. See ESCHEAT.

FUGITIVE SLAVE LAW. Slaves being regarded as property, things and not persons, as the Roman law puts it, the existence in every state in which slavery exists of a law recognizing the right of the master to reclaim his property follows as a logical consequence. Accordingly, the constitution of the United States of America having recognized slavery, or "service," as it was gently termed by American writers, necessarily used to contain a number of enactments for its enforcement. By art. 4, s. 2 of that document, it was declared that persons held to service or labor in one state, under the laws thereof, and escaping into another, should be delivered up, on claim of the party to whom such service or labor might be due. In furtherance of this provision, the laws of New York provided for the arrest of such fugitives, on *habeas corpus*, founded on due proof, and for a certificate in favor of the right of the claimant, and delivery of the fugitive to him, to be removed. This obsolete law, as narrated in the latest edition of Kent, seems to have been to the following purport: The act of 1793, providing for the reclamation of fugitives from justice and from service, had, so far as relates to the latter, been amended, and to a considerable extent superseded, by the act of Sept. 18 1850. The judicial duties imposed by the latter act were to be performed by the U. S. commissioners, who might have the power of arresting or imprisoning for offenses against the United States, by the judges of the circuit and district courts of the United States, and of the superior courts of territories, and by such special commissioners as the respective courts might appoint. It was the duty of all U. S. marshals to obey and execute all warrants and process of such judges and commissioners; and after the arrest of any fugitives, such officers were liable for an escape with or without their assent. When any fugitive escaped into another state or territory, the owner, or his duly authorized agent, might pursue and personally arrest said fugitive, or might demand a warrant and arrest from the officer having due authority. The fugitive was then to be taken before a commissioner or judge, whose duty it was to hear and determine the

complaint in a summary manner. Should he have been satisfied of the validity of the claim and the identity of the slave, it was his duty to deliver to the claimant a certificate of the proceeding had, with authority to remove the fugitive to the place from which he fled. The testimony of the fugitive was not admissible. Any assistance rendered to a fugitive to enable him to escape from the claimant, or any obstruction offered to his arrest, was penal, and also subjected the party to damages at the suit of the owner. All citizens of the United States were required, when called upon, to render the officers personal assistance in the performance of their duties. These provisions applied to all the states previously to the war, whether slavery was recognized by their special laws or not; the principle being, that "the constitution and laws of the United States secure the right to reclaim fugitive slaves against state legislation." In some of the slave-holding states it was held that, if a slave from such a state went lawfully into a non-slave-holding state, and acquired a domicile there with his master, or was emancipated there, he became emancipated, and ceased to be a slave on his return; but if he were carried there for a temporary purpose, and returned, his state of slavery was resumed. These provisions did not apply to the fugitive slave (Kent, *ut sup.* ii. p. 297.)

FU'GLEMAN (properly, *Flugelman*, from the German *flügel*, a wing), an intelligent soldier posted in front of a line of men at drill, to give the time and an example of the motions in the manual and platoon exercises. He originally stood in front of the right wing, and hence the name.

FUGUE, in music, is the name of a composition wherein the parts do not all begin at once, but follow or pursue one another at certain distances; thence the name, *fuga*, a flight or chase, each part successively taking up the subject or melody. Any of the parts may begin the F., but the others follow according to fixed rules. The subject is generally a few bars of melody, which is given out in the principal key by the part which begins. The next part which enters repeats the same melody, but a fifth higher or a fourth lower, and is called the answer. The third part follows with the subject again in the principal key, but an octave higher or lower than the first part, and is answered by the fourth part in the same manner as the second part answers the first. After the subject is completed, the melody which follows it, so as to form a continuation of the part, is called the counterpoint, in the construction of which, facilities for ingenious double counterpoints of various kinds are afforded. When the subject and answer have been introduced in all the parts, the first section of the F. is said to be completed; an intermediate harmony of a few bars then follows, sometimes in its form like part of the subject, and with a modulation into a nearly related key. The subject and answer are again brought forward, but following in a different order from the first section; while at the same time all the parts are continued, and in some of them the original counterpoint appears either simply or inverted, the subject and answer forming the predominating idea throughout the whole composition, and towards the end appearing in a variety of forms, intervals, and modifications. When the subject does not extend in compass beyond the half of an octave, the answer is invariably made in the other half: and to avoid modulation out of the key, the progression of a fifth is answered by a fourth. A F. consisting of one subject with a counterpoint throughout, is called a strict F., as in the following example by J. Sebastian Bach, in which the first progression of a fifth is answered by a fourth:



When a second subject is introduced in the middle of the composition, and afterwards worked up with the first subject, it is then called a F. on two subjects, as in the following Graun's *Tod Jesu:*

A double F. begins at once with two subjects in different parts, both of which are strictly treated throughout, as in the following from Mozart's *Requiem:*

A free F. is that in which the subject and counterpoint are not strictly treated throughout, but mixed up with intermediate harmonies and ideas not connected with the subject, while the rules of the F. are not rigidly adhered to. .

The F. has always been, and will continue to be, esteemed by every sound musician, not from its being the most difficult style of composition, but from its not being subject to caprice and fashion. The fugues of Bach, Handel, and other composers possess the same interest for the present time as they have done for generations past. Although the F. is held by many to be a mere mechanical study, which can be composed or written purely by rule and calculation, still, it undoubtedly holds out to a composer of genius a wide field for great and beautiful effects, as well as peculiar artistic combinations. The best works on the F. are by Marpurg, Albrechtsberger, Kirnberger, and the late prof. S. W. Dehn, of Berlin.

FUH CHOW. See Fu Chow Foo, *ante.*

FUH-HE, or Fu-he-she, the first of the five emperors of China that flourished in the mythological period. He instructed the people in the art of rearing cattle, and invented the *pă-kwă*, or eight combinations of four strokes, to express the changes of nature. His chief invention, however, was that of letters, by drawing up the two linear tables called ho-too and lo-shoo, which he copied from the back of a dragon rising from the deep. According to another account, knotted cords, 20 in. long, were used for writing, till Tsang-ke, the minister of F., conceived the idea of characters from seeing the footprints of birds on the sands. F. instituted marriage, invented the musical instrument called *kin*, and taught the art of fishing. It is clear that he personifies a condition of society. He had a head with projections like the horns of an ox, and the body of a dragon.—San-tsze-king, l. 21, 22; Kang-keen-e-che-luh, i. p. 6; Gutzlaff, *Sketch of Chinese History*, i. p. 119.

FUH-HE, or FUH-HE-SHE (*ante*), usually set down as the first of the emperors of China; possibly a real, but more likely a mythical person. His era would be about 8,000 B.C. It was an ancient belief of Chinese writers that there had existed a period of 2,267,000 and odd years between the time when the powers of heaven and earth first united to produce man as the possessor of the soil of China, and the time of Confucius. This having been accepted as a fact, it became necessary for the early historians to invent long lines of dynastic rulers to fill up the gap between the creation and the period with which the book of historical documents commences. Accordingly, we find a series of ten epochs described as preceding the Chow dynasty. The events connected with most of these are purely fabulous, and it is not until we come down to the eighth period that we can trace any glimmer, however obscured, of history. This, we are told, commenced with the reign of Yew-chaou She (the "Nest-having"), who, if such a man ever existed, was probably one of the first of those who, as the immigrants increased and multiplied, was chosen to direct their counsels and to lead their armies. This chief induced them to settle within the bend of the Yellow river, the site of the modern province of Shan-se, and taught them to make huts of the boughs of trees. Under the next chief, Suy-jin She ("the Fire-producer"), the grand discovery of fire was effected by the accidental friction of two pieces of dry wood. He taught the people to look up to Teen, the great creating, preserving, and destroying power; he invented a method of registering time and events, by making certain knots on thongs or cords twisted out of the bark of trees. Next to him followed Yung-ching She, and then Fuh-he, who separated the people into classes or tribes, giving to each a particular name, discovered iron, appointed certain days to show their gratitude to heaven by offering the first fruits of the earth, and invented the eight diagrams which serve as the foundation of the Yih-king. Fuh-he reigned 115 years, and his tomb is shown at Chin-choo, in the province of Shen-se, at this day. His successor, Chin-nung, invented the plow; and from that moment the civilization of China proceeded by rapid and progressive steps.

FUH-KEEN, or FU-KIAN (Happy Established, or the Consummation of Happiness), one of the eastern maritime provinces of China. It lies to the s. of Che-keang, between the parallels of 23° 35′ and 28° 47′, and is backed by the great southern range of mountains that separates south-eastern China from the inland provinces. F. belongs to the hilly portion of China proper. It is a black-tea district, and produces barley, wheat, rice, tobacco, yams, and other Chinese vegetables. The principal fruits are the orange, li-chee, olive, plum, pomello (a fruit of the sub-acid order, somewhat like an orange), plantain, and mulberry. On its coast are situated the ports of Fu-chow (q.v.) and Amoy, or Hia-mum (the gate or harbor of Hia), opened by the treaty of Nankin, 29th Aug., 1842. See CHINA. The island of Formosa and the Pang hoo group are included in this province. Area 53,480 sq.m.; pop. 38,880,432.

FÜHNEN (Dan. *Fyen*), the largest of the Danish islands after Seeland, is bounded on the w. by the Little Belt, which separates it from Jutland and Slesvig; on the n. by the Odensee fjord; on the e. by the Great Belt; and on the s. by the Little Belt, and by the small island of Langeland, which is incorporated with it in one circle, or *stift*, of the kingdom. The area of this stift is 1302 sq.m.; the population (1870) was 236,311. The coast is generally rugged, and much indented with bays or fjords; but the interior is flat, except towards the s. and w., where there is a range of hills rising to about 500 feet. The land, which is well watered by several small streams, is fruitful and well cultivated, producing abundant crops of cereals. Barley, oats, buckwheat, rye, flax, and hemp are grown in larger quantities than are required for home consumption. Honey is also largely exported. The F. horses are in great request, and large numbers of these animals, and of a fine breed of horned cattle, are annually sent out of the island. The province of F. is divided into the two bailiwicks of Odensee and Svendborg. The principal towns are Odensee (q.v.), Svendborg (q.v.), and Nyborg—pop. '70, 4,812—a fortified town on the e. coast, and the most direct port of communication with Seeland, and memorable as having been the seat of the annual Danehof, or meeting of the states, instituted in 1354 by Valdemar IV., and for the victory gained in 1659 by the Danes and their allies over the Swedes.

FUHRICH, JOSEPH VON, b. Bohemia, 1800; studied painting in Rome and other places, and was appointed professor of historical painting in the Vienna academy of fine arts. His best works are on scriptural subjects, and many churches possess his pictures.

FUH-SHAN, or FAT-SHAN, a city of China, in Quang-tong, 6 m. s.w. of Canton. In consequence of having a number of extensive iron-works it has been called the "Birmingham of China."

FUJI-YAMA, or FUSI-YAMA (*No-Awo-such* mountain, or "Rich Scholar" peak), an extinct volcano of peerless form, in the province of Suruga, Japan; the sacred mountain of the Japanese. According to tradition, Fuji was cast up by volcanic upheaval 285 B.C., when at the same time the earth sank, and lake Biwa in Omi province was formed. In 800 and 864 A.D., frightful eruptions took place which greatly increased the size of the mountain, and perfected its cone-like shape, whilst vast masses of rock were thrown out as far as the sea. In 1707, the eruption which formed the hump on the southern side took place. Other less fearful eruptions occurred in 936, 1031, 1082, and 1649.

This dormant, but perhaps not extinct volcano, has a crater 500 ft. deep. An examination of several scientific measurements of its height gives an average of 12,000 feet. Five lakes lie at the base of F., which covers many square leagues of surface. The mountain is visible from 13 provinces, and from a great distance at sea. It is cultivated to the height of 2,000 ft.; then succeed plains of grass and forests, the lava cone having no vegetation. Immense numbers of pilgrims ascend the mountain yearly from May to November.

FULAHS [properly *Fúlbe* (sing. *Púllo*), called also Féllani (sing. Baféllanchi), Felláta, and Fullán], the name of a widely-spread negro people in upper Súdán, regarding whose origin there is much diversity of opinion. M. Eichwaldt (see *Journal de la Société Ethnologique*. 1841, vol. i. p. 2, et seq.) has endeavored to connect them with the Malays in the far east, but according to Dr. Barth, "none of his arguments are of any consequence." Yet Dr. Barth himself is of opinion that "their origin is to be sought for in the direction of the east; but this," he adds, "refers to an age which for us is enveloped in impenetrable darkness." The F. first emerge into the light of history about the beginning of the 14th c., when, as we learn from Ahmed Bábá's *History of Súdán*, two members of the tribe went on a religious mission from Melle, on the borders of Senegambia, to the king of Bórnu. The importance of this incident lies in the fact, that it shows that in the dawn of their history—as has invariably been the case in later times—the course of the tribe was from *west* to *east*, and also, that at the early period referred to, they were distinguished for that religious learning which still characterizes them. After the 14th c., successive swarms of F. appear to have left the kingdom of Melle, or the mountainous region of Fuládu, and to have spread themselves over the greater portion of Súdán, "absorbing and incorporating with themselves different and quite distinct national elements, which have given to their community a rather varying and undecided character." Hence originate the conflicting accounts of travelers, some of whom speak of the F. as differing little from the negroes; others, as having their features and skulls cast in the European mold; while Bowen describes those of Yoruba as being some black, some almost white, and many of a mulatto color, varying from dark to very bright. Many other tribes, which have not been quite absorbed by the F., are yet so far blended with them, that they have lost their native idiom altogether, and speak the language of the predominant race, which is termed the Fulfúlde. The F. are not all under one ruler; they are a *race*, not a *nation;* and have founded many kingdoms, such as those of Sókoto, Gando, Timbo, etc. The endless tribes belonging to their stock are generally divided into four groups or families, the Jel, the B'aá, the Só, and the Beri. Most of them became converted to Mohammedanism about the middle of the 18th c., and in 1802, under the Imám Othman, commenced a religious war on the surrounding pagans, which terminated prosperously in the establishment of the great Fulah empire of Sókoto. Othman died in a sort of fanatical ecstasy or madness, in 1818. The F. are industrious and inclined to trade; they work iron and silver; manufacture with great neatness articles in wood and leather, and weave various durable fabrics. They are by far the most intelligent of the inhabitants of Súdán, and have, besides mosques, schools in almost all their towns.

FULCO, or FOULQUES, OF NEUILLY, a famous pulpit orator of the 12th c., the foremost preacher of the fifth crusade. After a careless youthful life, he was converted by Peter the chanter, and suddenly became the most austere of ascetics. He commenced a series of journeys as a preacher, exhorting the people to repentance, and by the rigor of his ascetism enforcing his sermons. His clothing was of the coarsest description, and his eloquence was so great that, as he passed through the villages, the people prostrated themselves, confessing their sins and protesting their intention of leading new lives, and expiating the sins they had committed. Many followed his example, and began to teach and to preach. He died before the crusaders reached Palestine.

FULCRUM, in mechanics, is the prop or fixed point on which a lever moves. See LEVER.

FULDA, a t. of Germany, in the Prussian province of Hesse-Nassau, 54 m. s. of Cassel, is pleasantly situated on a rising-ground on the right bank of the Fulda, a considerable stream, which, rising from the western base of the Rhöngebirge, in Bavaria, flows northward through Hesse-Cassel, and unites with the Werra on the Hanoverian border, after a course of 110 miles. It is a pretty town, surrounded by old walls, and has a market-place, two squares, and eight suburbs. One of the chief buildings is the cathedral, the fourth church that has been built on this site. It is a handsome modern structure, and covers the shrine in which the body of St. Bonifacius was deposited after his murder by the Frisians, in 754. The other notable structures are the palace, formerly the residence of the prince-bishops of F.; the church of St. Michael, founded in 822; a gymnasium, schools of art and manufactures, and a public library. F. has acquired a reputation for its linen manufactures; it has also extensive establishments for the manufacture of vinegar and beer; with dye-works, tanneries, and weaving. Pop. '75, 10,799, mostly Roman Catholics. The district of which F. is the capital, forms part of what was formerly the grand-duchy of Fulda. This territory was incorporated with the grand-duchy of Frankfort by Napoleon in 1810, and ceded to Prussia in 1815, but immediately afterwards was made over to Hesse-Cassel (q.v.).

FULDA MANUSCRIPT, a complete and highly esteemed copy of the early Latin version of the New Testament, written in 546 by the command of Victor, bishop of Capua, and now among the treasures of the abbey of Fulda. In it an effort has been made towards an arrangement of the gospels in harmony with each other. It has been collated by Lachmann and Buttmann, and is to be printed.

FULDA, MONASTERY OF, was founded in 744 by Boniface, "the apostle" of Germany, who sent Sturmius, one of his followers, to search for a suitable site secure from Saxon attack. This was discovered on the banks of the Fulda, in the depths of the forest, within what afterwards became the duchy of Hesse-Cassel. A grant of the spot, with 4 m. of surrounding territory, was obtained from Carloman, son of Charles Martel. Boniface superintended the clearing of the ground and the erection of the building, while Sturmius spent a year in Italy, visiting the monasteries, and studying the mode of life pursued at the celebrated Benedictine convent of Monte Cassino. The Benedictine rule having been adopted, Sturmius was made abbot, and, with seven helpers, began the work of preaching, instruction, and civilization. The rude tribes were taught agriculture, building, and other peaceful arts. A school was established on the model of those taught by Patrick and Columbo in the British isles. This soon became the most important work of the monastery, and a center of mediæval theological learning. Under Rabanus Maurus, the first of the schoolmen, there were 12 instructors who taught grammar, rhetoric, logic, the German language, and theology, together with a practical knowledge of mechanics and fine arts. Many princes, afterwards famous, were educated there. Alcuin, in his great work of founding and advancing universities in continental Europe, looked for help to Fulda as one of the acknowledged centers of learning. There also originated many other missionary monasteries, the most celebrated of which was Hirsgaw, in the diocese of Speier. In 968, the abbot of Fulda was made primate of the abbeys of Germany. But with the advance in influence and wealth there was an increasing corruption in many of the monasteries; and from this Fulda did not escape. At the beginning of the 11th c., a reform was attempted by substituting new monks from Scotland for the old, and re-establishing in all its strictness the Benedictine rule. The reformation of the 16th c. seems to have been welcomed by many of the monks; but in 1573, the abbot thoroughly effected among them the suppression of evangelical doctrine.

FULFORD, FRANCIS, D.D., 1803–68. b. England, educated at Exeter college, and afterwards held positions of importance in the English church. In 1850, he was made lord bishop of Montreal and metropolitan of Canada. His publications are *Progress of the Reformation*, and several volumes of sermons.

FULGENTIUS, FABIUS CLAUDIUS GORDIANUS, SAINT, b. Africa, 468 A.D. He was in Rome at the age of 32, and on his return to Africa founded a monastery and became distinguished for devotion and learning. He was made a bishop in 504, and was recognized as one of the ablest defenders of Christianity against Arianism and Pelagianism; explaining the system of Augustine with consistency, but avoiding the harsh points of the predestinarian view. Yet even he held that all unbaptized children, even those not yet born, are consigned to damnation. He was twice banished, but recalled, and passed his latter years in peace. The Roman Catholic church commemorates his death on the first day of the year.

FULGENTIUS, FABIUS PLANICADES. A writer whose life is little known. Several voluminous works are attributed to him, and amongst them one which later research has definitely proved to have proceeded from the pen of Fabius Claudius Fulgentius. The title of this book is *Liber Voluminum XIII. de Ætatibus Mundi et Hominis*, and is in as many volumes as there are letters of the alphabet. Of the 23 only 14 are extant, and were reissued by a Parisian publisher in 1696.

FULGORA. See LANTERN FLY.

FULGURITES (Lat., *fulgur*, lightning), tubes formed of vitrified sand, which are found in sand-banks, and in soils consisting chiefly of siliceous sand, and are attributed to the action of lightning melting and vitrifying the sand. They were first discovered in 1711 by the pastor Herman, at Massel, in Silesia, and have since been found in many places; but their origin was first pointed out by Dr. Hentzen in 1805. They are from a quarter of an inch to two inches and a half in diameter, their internal surface of a perfectly glassy substance, hard enough to scratch glass, and to give fire with steel. They are usually, but not always, placed vertically in the sand, become narrower downwards, and sometimes divide and subdivide into branches.—The effects of lightning seem to be exhibited also in some places on rocks by vitrification and the production of a sort of enamel, sometimes assuming the form of beads.

FULHAM, formerly a village, but now a suburb of London, in the s. of Middlesex, on the left bank of the Thames, 6 m. s.w. of St. Paul's.

FULICA. See COOT.

FULIGULA. See POCHARD.

FULLER, ANDREW, an eminent Baptist minister, and theological and controversial writer, the son of a small farmer, was b. at Wicken, Cambridgeshire, Feb. 6, 1754. He received the rudiments of his education at the free school of Soham, and in his youth was principally engaged in agricultural labors. In his 17th year, he became a member of a Baptist church at Soham, and in 1775, he was chosen pastor of a congregation at that place. His small stipend of £21 per annum he endeavored to increase by keeping, first a small shop, and then a school. In 1782, he removed to Kettering, Northamptonshire, to take the pastorate of a congregation there. On the formation, in 1792, of the Baptist missionary society by Dr. Carey, himself, and eleven other ministers, he was appointed its secretary, and the whole of his future life was devoted to the administration of its affairs. In 1794, he published a controversial treatise, entitled *The Calvinistic and Socinian Systems. examined and compared as to their Moral Tendency* (Lond. 8vo). This work was attacked by Dr. Toulmin and Mr. Kentish, and F. replied in a pamphlet, entitled *Socinianism Indefensible* (Lond. 1797, 8vo). His other principal publications are *The Gospel its own Witness* (Clipstone, 1797), and *Expository Discourse on the Book of Genesis* (2 vols. 8vo, Lond., 1806). He was also the author of a variety of single sermons and pamphlets. The sense, sagacity, and thoroughly practical knowledge of mankind which these writings display, have won for F. the title of "the Franklin of theology." He died May 7, 1815. Three collected editions of his works have been published, besides American reprints; the first in 10 vols. 8vo, the second in 5, and the third in 1 royal 8vo. A volume of his treatises was republished in Bohn's standard library, with a memoir by his son. F.'s *Memoir of the Rev. Samuel Pearce of Birmingham* is much esteemed as a religious biography.

FULLER, ARTHUR BUCKMINSTER, 1822–62; b. Mass., graduated at Harvard, and studied theology in the Cambridge divinity school. He was a teacher and preacher in Illinois; and pastor in Boston and Watertown. He volunteered in the union army in the rebellion, and was made chaplain in a Massachusetts regiment. At Fredericksburg he was killed by a sharpshooter. He was a brother of Margaret Fuller (marchioness d' Ossoli), and edited her works.

FULLER, JOHN W., b. England, 1827; came to the United States in 1833, and established himself as a bookseller. He volunteered for the union in the war of the rebellion, and served with the Ohio troops with distinction, rising to the rank of brevet maj. gen. in 1865.

FULLER, SARAH MARGARET, Marchioness OSSOLI, one of the most remarkable women of the time, was b. at Cambridgeport, Mass., May 23, 1810. Her father, Timothy Fuller, was an advocate, and gave his daughter an excellent education, and nurtured her with great care. At eight years of age she wrote Latin verses; and philosophy, history, and æsthetics were her favorite studies. At ten she red Tasso and Ariosto in the original, and subsequently made herself familiar with the German writers, Tieck, Schelling, and Novalis. After her father's death she assisted her family by private teaching, and in 1839 she founded a society for ladies, where she herself delivered lectures. From 1839–44, she edited *The Dial*, to which she contributed many admirable articles. In compliance with an invitation she received from Horace Greeley, the editor of the *Tribune*, she proceeded to New York in 1844, and contributed to that journal a series of articles on literature and art, which have since appeared in a collected form under the title of *Papers on Literature and Art* (London, 1846). In 1850, she published *Woman in the Ninteenth Century*, in which she very ably discusses the nature and destiny of woman, and claims for the sex rights which have been long denied it. In 1846, she proceeded to England, where she made the acquaintance of Carlyle, for whom she had long entertained a high esteem. At Paris she gained the friendship of Mme. Dudevant, better known by her pseudonym of George Sand. Proceeding next to Rome, she there came in contact with the marquis d'Ossoli, to whom she was afterwards married in Dec., 1847. She took an active share in the political questions that agitated those times. In 1849, during the siege of Rome, she took the charge of an hospital; and viewed with feelings of pain the downfall of the new and ephemeral Roman republic. In 1850, she set out on her return journey to America, accompanied by her husband and newly born infant; but just as they came within sight of New York, on July 16, a hurricane burst upon the devoted ship which carried them, and the three perished in the waves. Her memoirs were published by Emerson and Channing under the title of *Memoirs of Margaret Fuller, Marchesa Ossoli* (London, 1852).

FULLER, RICHARD, D.D., 1804–76; b. S. C. At twenty years of age he chose the law as a profession, but afterwards united with the Protestant Episcopal church, and later still entered the Baptist ministry. In 1847, he became pastor of the Seventh Baptist church in Baltimore, where he remained till his death. He has published *Letters on the Roman Chancery; Correspondence on Domestic Slavery; Baptism and Communion; Sermons;* etc. He held a high rank among American preachers for eloquence and spiritual power.

FULLER, THOMAS, D.D., an eminent English historian and divine, was b. in 1608 at Aldwinkle, Northamptonshire, of which parish his father was rector. He was educated at Queen's college, Cambridge, and greatly distinguished himself by his application to

study. He took the degree of A.B. in 1624, and that of A.M. in 1628. He stood so high in the estimation of his college, that, before he was 23 years of age, he was appointed to St. Benets, Cambridge, and acquired great popularity as a preacher. Soon after, he was collated to a prebend in Salisbury cathedral, and obtained a fellowship in Sidney Sussex college. His first publication was a poem, entitled *David's Heinous Sin, Hearty Repentance, and Heavy Punishments* (1631, 8vo). He was next presented to the rectory of Broad Windsor, Dorsetshire; published his *History of the Holy War* at Cambridge in 1639; and in 1640 removed to London, where he was chosen lecturer at the Savoy church in the Strand. The same year, he was a member of the convocation at Westminster, and one of the select committee appointed to draw up new canons for the better government of the church. During the civil war he adhered firmly to the royal cause; and shared in its reverses. In 1646, however, he was chosen lecturer, first, at St. Clement's lane, Lombard street, and afterwards at St. Bride's. About 1648, he was presented to the living of Waltham, in Essex. In 1650, he published a geographical account of the Holy Land, entitled *A Pisgah Sight of Palestine and the Confines thereof* (folio, with maps and views), and *Abel Redivivus*, a collection of lives of modern divines. In 1655, he published at London *The Church History of Britain, from the Birth of Jesus Christ until the year* 1648 (folio). In 1658, he received the living of Cranford, Middlesex, and at the restoration he was reinstated in his prebend of Salisbury, of which he had been deprived by the parliamentarians. He was also appointed chaplain extraordinary to the king, and created D.D. at Cambridge by royal mandamus. He died Aug. 16, 1661. His principal work, *The Worthies of England*, was published at London in 1662 (folio). Valuable for the information it contains on provincial history, it abounds in biographical anecdote, witty remark, and acute observation on men and manners. A new edition, with his life prefixed, appeared in 1810 (2 vols. 4to). His *Holy and Profane States* were republished in America in 1831. Quaint humor is one of F.'s peculiar characteristics; but his writings are no less remarkable for wisdom, imagination, and, when occasion demands, even for pathos. "Next to Shakespeare," says Coleridge, "I am not certain whether Thomas Fuller, beyond all other writers, does not excite in me the sense and emulation of the marvelous. . . . He was incomparably the most sensible, the least prejudiced great man, in an age that boasted of a galaxy of great men."

FULLER'S EARTH, a mineral consisting chiefly of silica, alumina, and water, with a little magnesia, lime, and peroxide of iron. The silica is about 50, the alumina 20, and the water 24 per cent of the whole. It is regarded as essentially a hydrous bisilicate of alumina. It occurs in beds, associated with chalk, oolite, etc.; is usually of a greenish-brown or a slate-blue color, sometimes white; has an uneven earthy fracture, and a dull appearance; its specific gravity is from 1.8 to 2.2; it is soft enough to yield readily to the nail; is very greasy to the touch; scarcely adheres to the tongue; falls to pieces in water, but does not become plastic. It has a remarkable power of absorbing oil or grease; and was formerly very much used for fulling cloth (see WOOLEN MANUFACTURE), for which purpose it was considered so valuable, that the exportation of it from England was prohibited under severe penalties; it is still used to a considerable extent. The annual consumption in England is said to have at one time exceeded 6,000 tons. It is found at Nutfield, near Reigate, in Surrey, in cretaceous strata; where there are two distinct beds, the upper one of a greenish color, and 5 ft. thick, resting on the other, which has a bluish tint, and is 11 ft. thick. It is also found in Bedfordshire, Nottinghamshire, and Kent; and on the continent in Saxony, Bohemia, and near Aix-la-Chapelle. There is a considerable deposit of it at Bath, where the group of associated blue and yellow clays and marl has received the name of "the fuller's earth series." It is also found at Maxton, in Scotland.

FULMAR, or FULMAR PETREL, *Procellaria* or *Fulmarus*, a genus of birds generally referred to the gull family (*laridæ*), and containing some of the most strictly oceanic birds. See PETREL. The bill is not longer than the head—large, strong, and subcylindrical; the upper mandible suddenly hooked at the point; the lower mandible with the tip curved upwards; the tips of both mandibles appearing as separate pieces firmly joined to the straight part of the bill, which is marked by longitudinal grooves; the nostrils inclosed in a tube open at the extremity, and extending along the ridge of the upper mandible. The tarsi are compressed; the hind-toe rudimentary, a mere claw. The tail is short, and slightly rounded; the wings are long. The COMMON or NORTHERN F. (*P.* or *F. glacialis*) is a bird about the size of a duck, gray above, white beneath, the head and neck pure white, the tail white, the bill yellow; the young brownish gray. It inhabits the most northern seas, in which its numbers are prodigious; breeds on the rocky shores of the Faröe islands, Iceland, Greenland, Spitzbergen, etc., on the grassy shelves of the precipices, making a slight nest or a mere excavation, in which it lays one egg. It is rarely to be seen on the southern coasts of Britain, but more frequently in Orkney and Shetland, where however, it is said never to breed, although it breeds in great numbers in St. Kilda and the adjacent islets of Borrera and Soa. It greatly frequents these isles, and is of importance to the inhabitants of St. Kilda, who esteem its eggs and flesh above those of any other bird, and seek them in the most perilous manner, descending by ropes from the summit of the precipices. The fulmars are also valued for their feathers, for their down, and for their oil, which is one of the principal

products of St. Kilda, and is obtained from their stomachs. The old are said to feed the young with it; and when they are caught or assailed, generally lighten themselves by disgorging it. It is amber-colored, and has a peculiar and very disagreeable odor. Fulmars feed on all animal substances which come in their way, giving an evident preference to fat, and delighting in the blubber of whales. They pursue whales to prey on the cirrhopods which are attached to them, or imbedded in their skin. Multitudes of them soon gather around a dead whale, and they are so bold as to advance within a few yards of the men who are cutting it up. When food is abundant, they often glut themselves till they are unable to fly. They follow the greasy track of a whaler, and, indeed, some of them are always in attendance on ships immediately after they pass north of the Shetland islands, ready to seize any garbage that may be thrown overboard. Sailor boys often amuse themselves in catching them by means of lines and hooks baited with fat.

Another species of F. (*P.* or *F. Pacifica*) exists in the Pacific ocean, and the MOTHER CAREY'S GOOSE of sailors, a large bird of the southern seas, is sometimes referred to the same genus.

FULMINATE OF MERCURY, or FULMINATING MERCURY ($2HgO,C_4N_2O_2$), is best prepared by dissolving 3 parts of mercury in 36 of nitric acid of specific gravity 1.34, without the application of heat, in a flask capable of holding 18 times the bulk of the acid. The solution is then to be poured into a large vessel containing 17 parts of alcohol of specific gravity 0.830, and immediately to be re-transferred to the flask, which is still full of nitrous vapors, and with which it must be well shaken, in order to effect their absorption. Effervescence commences in a few minutes, and soon becomes extremely violent; and at the same time there is a deposit of metallic mercury, which is gradually re-dissolved. The reaction must be moderated by the gradual addition of 17 parts more of alcohol; and on cooling, crystals of the fulminate, amounting to 4.6 parts, are deposited. These must be washed with cold water, and dried at 100°F. Fulminate of mercury forms white silky needles. It may be handled without much danger when moist; but when dry, it explodes with violence when struck by a hard body, or when touched with nitric or strong sulphuric acid. A mixture of 1 part of this salt with six parts of niter, or of 3 parts of the fulminate, 5 of chlorate of potash, 1 of sulphur, and 1 of ground glass, is employed as the priming of percussion-caps. It is applied as a dry powder, and is made to adhere to the cap by the application of a drop of shellac varnish.

FULMINATE OF SILVER, or FULMINATING SILVER ($2AgO,C_4N_2O_2$), is prepared in nearly the same manner as the fulminate of mercury. It is more powerfully explosive than the last-named salt. Even when moist or under water, pressure with a hard body will cause its explosion; and when quite dry, the slightest friction between two hard bodies produces a similar result.

The preparation of the fulminates is attended with very considerable danger, and should be attempted by none but professed chemists.

FULMIN'IC ACID has never been isolated in the hydrated form, but from the composition of its salts, its formula doubtless is $2HO,C_4N_2O_2$. It is thus isomeric with cyanic acid. Fulminic acid may be separated from the oxide of mercury and silver, and combined with other bases, such as potash; and all such compounds are more or less explosive.

FULTON, a co. in n. Arkansas, on the Missouri border, intersected by Spring river; 658 sq.m.; pop. '70, 4,843—84 colored. Surface hilly, and covered to a great extent with forests. The soil is fertile, producing corn, cotton, etc. Co. seat, Salem.

FULTON, a co. in n.w. Georgia, on the Chattahoochee; 200 sq.m.; pop. '70, 33,446—15,282 colored. It is intersected by five railroads which concentrate at Atlanta, the co. seat. Surface hilly; soil fertile, producing cotton, corn, etc.

FULTON, a co. in w. Illinois, bounded by the Illinois and intersected by Spoon river, and crossed by three important railroads; 870 sq.m.; pop. '70, 38,291. There are mines of bituminous coal, and plenty of hard timber. The surface is undulating and the soil fertile, producing corn, wheat, oats, hay, pork, cattle, etc. Co. seat, Lewistown.

FULTON, a co. in n. Indiana on Tippecanoe river, crossed by the Indianapolis, Peru, and Chicago railroad; 66 sq.m.; pop. 12,726. It is level, largely covered with forests, and the soil is fertile. The chief productions are wheat, corn, hay, and pork. Co. seat, Rochester.

FULTON, a co. forming the s.w. corner of Kentucky on the Tennessee border and the Mississippi river, intersected by the Mobile and Ohio, and the Nashville, Chattanooga, and St. Louis railroads; 200 sq.m.; pop. '70, 6,161—937 colored. It is level, and the soil is fertile; chief productions, corn, cotton, tobacco, pork, etc. Co. seat, Hickman.

FULTON, a co. in e. central New York, bounded on the w. by East Canada creek, and connected with the New York Central railroad by the Fonda, Johnstown, and Gloversville road; 530 sq.m.; pop. '75, 30,155. The surface is hilly; soil mostly fertile,

producing corn, oats, hay, butter, cheese, etc. There are many extensive manufactories, especially of gloves and mittens. Co. seat, Johnstown.

FULTON, a co. in n.w. Ohio, on the border of Michigan, drained by tributaries of Maumee river, and intersected by the Lake Shore and Michigan Southern railroad; 337 sq.m.; pop. '70, 17,789. It is undulating and abounds in forests. The soil is fertile; chief productions, wheat, corn, hay, etc. Co. seat, Wauseon.

FULTON, a co. in s. Pennsylvania on the Maryland border, drained by Licking creek and tributaries of the Potomac; 380 sq.m.; pop. '70, 9,360. It is a rough mountainous region, having Sideling hill on the w. and Tuscarora mountain on the east. The valleys are fertile, producing corn, oats, hay, etc. Co. seat, McConnellsburg.

FULTON, the seat of justice of Callaway co., Missouri, on the Chicago and Alton railroad, 26 m. n.n.e. of Jefferson City; pop. 1585. It is the seat of two state institutions—one for the deaf and dumb, and one for the insane. The Westminster (Presbyterian) college is here, founded in 1852; and there is a female seminary. There are also some manufactures.

FULTON, a village in Fulton co., N. Y., on the New York and Oswego Midland, and the Syracuse and Oswego railroads, on the e. bank of the Oswego river, 24 m. n.w. of Syracuse; pop. 3,507. It contains manufactories of flour, woolen goods, machinery, etc.; a seminary, and a graded school, and issues two newspapers.

FULTON, JUSTIN D., D.D., b. New York, 1838; graduated at Rochester university and the theological seminary in the same city; ordained in 1854 to the Baptist ministry in St. Louis, where he was editor of the *Gospel Banner*. Since then he has had pastoral charges in Sandusky, O.; Albany and Boston, and since 1873 in Brooklyn, N. Y. Among his works are *Roman Catholic Element in American History; Woman as God Made Her; Rome in America; Radicalism; The Sabbath;* etc. He is an earnest denominationalist, and has taken active interest in the temperance and woman's rights movements.

FULTON, ROBERT, a celebrated American engineer, was b. at Little Britain, Pennsylvania. His parents belonged to Ireland, whence they emigrated to America; and being in poor circumstances, all the education young F. acquired was the ability to read and write. He made good use, however, of what he had acquired, and passed in study the time allowed him for recreation. When he was old enough, his mother apprenticed him to a jeweler in Philadelphia. In addition to his labors at this trade, he devoted himself to painting; and the sale of his portraits and landscapes enabled him, in the space of four years, to purchase a small farm, on which he placed his mother, his father being dead. At the age of 22, he proceeded to London, where he studied painting under West; but after several years spent thus, he felt that this was not his true vocation. Accordingly, abandoning painting, he applied himself wholly to mechanics. Some works he performed in Devonshire obtained him the patronage of the duke of Bridgewater, and likewise that of the earl of Stanhope. In 1794, he obtained from the British government a patent for an inclined plane, the object of which was to set aside the use of locks; and in the same year, he invented a mill for sawing and polishing marble. His next invention was a machine for spinning flax, followed by one for making ropes. He was received as a civil engineer in 1795; and wrote a work on canals, in which he developed his system. Accepting an invitation from the United States minister at Paris, he proceeded to that city in 1796, and remained there for seven years, devoting himself to new projects and inventions. Amongst his inventions here was the *nautilus* or submarine boat, intended to be used in naval warfare, which he in vain sought the French government to accept; nor was he more successful with the British government, which he next tried, though commissions were appointed in both cases to test the value of his invention. Having failed in this matter, he next turned his attention to a subject that had frequently occupied his mind before, and about which he had written a treatise in 1793—viz., the application of steam to navigation. In 1803, he constructed a small steam-boat, and his experiments with it on the Seine were attended with great success. Disgusted with the reception he met, he returned in 1806 to New York, and pursued his experiments there. He perfected his *torpedo* (q.v.) system, which was afterwards employed effectively in the war between Britain and America. In 1807, he launched a steam-vessel upon the Hudson, which made a successful start, in the presence of thousands of astonished spectators. From this period, steamers (for the construction of which F. received a patent from the legislature) came into pretty general use upon the rivers of the United States. Although F. was not the first to apply steam to navigation, as a steam-vessel had been tried upon the Forth and Clyde canal as early as 1789, yet he was the first to apply it with any degree of success (see STEAM-NAVIGATION). His reputation was now firmly established, and he was employed by the United States government in the execution of various projects with reference to canals and other works. In 1814, he obtained the assent of the legislature to construct a steam-frigate, which was launched in the following year. Though the labors of F. were attended with such great success, various lawsuits in which he was engaged in reference to the use of some of his patents, prevented him from ever becoming wealthy; and anxiety, as well as excessive application, tended to shorten his days. His death, in 1815, produced extra-

ordinary demonstrations of mourning throughout the United States. F. had married, in 1806, a niece of Robert Livingston, United States minister in France.

FULVIA, a Roman woman, lived about 80–40 B.C. She was the daughter of Fulvius Bambalio, and was married three times—her third husband being Marc Antony, for whose sake she abandoned a dissolute life. By him she had two sons. When he allowed himself to be detained in Egypt by Cleopatra, F. stirred up an insurrection to compel his return home; and to revenge herself at the same time upon Octavius, who had married and repudiated her daughter Clodia. The insurrection was quelled, and she fled to Greece, where Antony met her with many reproaches. She died of disappointment, and Antony married Octavia, sister of Augustus. It is recorded of F. that when the head of Cicero was brought to her she thrust a needle through the tongue.

FUM, or, more properly, FUNG—the first being the Portuguese pronunciation of the word; the Chinese phœnix—one of the four symbolical animals supposed to preside over the destinies of the Chinese empire. Its appearance indicates an age of universal virtue, the influence of which has extended throughout creation. It is supposed to originate from the element of fire, and to be born in the Tan-heuĕ, or Hill of the Fiery Halo of the Sun; to have the forepart of a goose, hind-quarters of a stag, neck of a snake, fish's tail, fowl's forehead, down of a duck, dragon's marks, the back of a tortoise, face of a swallow, and beak of a cock, with beak, claws, and feathers of various colors, red crest, and golden beak. It is about six cubits high, and comes from the east. In mystical language, it is called the Leĭh-kwan, or "mandarin of time," and it is said to have a forehead like heaven, eyes like the sun, back like the moon, wings like the wind, feet like earth, and a tail like the planets. On its body are inscribed the five cardinal virtues. According to some authors, it only perches on the woo-tung tree, and eats the seeds of the bamboo; others describe it as swallowing small carp. Other accounts say it eats no living insect, and treads on no growing plant. Its voice is said to be like a flute, drum, or even thunder. When seen, it is followed by birds. According to Chinese history, it has occasionally appeared; and a celebrated female flute-player, named Lung-yu, is said to have enticed it from heaven with her music, and then fled away with it. Like the phœnix of the Egyptians and roc of the Arabs, the bird may have had a historical origin, subsequently disfigured by fiction. It is often represented on Chinese works of art, under the form of a gallinaceous bird, and is embroidered on the dresses of mandarins of a certain rank. It is mentioned by some modern English poets.—Kidd, *History of China*, p. 267; Ching-tsze-tung, 172 sect.; Yuen-keen-luy-han, 148 sect.

FU'MAGE, in the law of England, was properly smoke farthings, or a customary payment for every house that had a chimney or fire-hearth. This tax is mentioned in Domesday as paid by custom to the king for every chimney in the house. Edward the Black Prince is said to have imposed a tax of a florin for every hearth in his French dominions. The first statuary enactment on the subject in England is by 13 and 14 Car. II. c. 10, whereby a tax of 2*s*. on every hearth in all houses paying to church and poor was granted to the king forever. This tax was abolished 1 William and Mary, st. 1, c. 10.

FUMARIA'CEÆ, a natural order of exogenous plants; herbaceous, with a watery juice; their leaves alternate, much divided; the calyx of two deciduous sepals; the corolla of four very irregular petals; the stamens sometimes four and distinct, more generally six and in two bundles; the ovary free, one-celled, one-seeded, or many-seeded; the seeds having large albumen. The F. are regarded as in their botanical characters approaching most nearly to the *papaveraceæ* (poppy, etc.); but their general aspect is very different, and they do not possess the same powerful properties. Both the foliage and flowers of some have considerable beauty. *Dielytra spectabilis* is a well-known favorite in gardens and green-houses. More than one hundred species are known, mostly natives of temperate climates in the northern hemisphere. Several species of *fumaria* and *corydalis* are natives of Britain. The COMMON FUMITORY (*fumaria officinalis*) is a very frequent weed in gardens and cornfields, but of rather delicate and beautiful appearance. It is annual, and easy of extirpation, where it springs up in excessive abundance. It was formerly much employed in medicine, having a high reputation as a tonic and diaphoretic, and although disused in Britain, is still esteemed in France as a remedy in scorbutic affections, chronic eruptions, etc. Some of the other species of fumitory possess similar properties. The leaves have an intensely bitter saline taste.

FUMAR'IC ACID, known also as boletic acid ($2HO,C_8H_2O_6$), is of frequent occurrence in the vegetable kingdom. It was first obtained by Braconnot from a species of boletus, and has since been found in many other fungi, in numerous lichens, in various species of fumaria, in corydalis bulbosa, etc.

F. A. may also be obtained, in association with malæic acid, by heating malic acid (q.v.) to 350° F.

It crystallizes in prisms, which have a very acid taste, are only slightly soluble in water, but dissolve readily in alcohol and ether. At a temperature of 392° F. it volatilizes without fusing, and is converted into the malæic acid already mentioned, which

possesses the same composition as F. A., but different properties. If malæic acid is exposed for a long time to a temperature of 266°, it again passes into F. A., so that these acids are mutually convertible.

Kekulé has shown (*Annalen d. Chemie*, 1861) that both F. A. and malæic acid combine directly with bromine, and produce crystals of dibromo-succinic acid; and further, that if F. A. be dissolved in water, and digested with an amalgam of sodium, the nascent hydrogen from the decomposed water combines with the acid, and converts it into succinic acid. Its compounds are of no special interest.

FUMBINA. See ADAMAWA.

FU'MIGATING PASTILS are composed of various ingredients, which, by their smoldering combustion, evolve agreeable odors. The following recipe for their composition is given in the Würtemberg pharmacopœia: Take of benzoin and dry balsam of Peru, each 16 parts; of yellow sandalwood, 4 parts; of labdanum, 1 part; of charcoal from lime-tree wood, 96 parts; of nitrate of potash, 2 parts; and of mucilage of tragacanth, enough to form the mixture into a paste, from which conical pastils are to be made by a small mold.

The "ribbon of Bruges" is also employed for aromatic fumigation in the same manner as pastils. It is prepared as follows: Dissolve two ounces of nitrate of potash in a pint of water; in this fluid, steep good undressed cotton-tape, and hang it up to dry Prepare a tincture composed of spirit, half a pint; musk, half an ounce; otto of roses, one dram; benzoin, four ounces; myrrh, half an ounce; orris-root, half a pound. When this tincture has stood for a month, steep the prepared tape in it. The tape when dried is fit for use. Light it, blow out the flame; and as it smolders, a fragrant vapor will rise into the air. For further information on this and allied subjects, see Piesse's *Art of Perfumery*.

FUMIGA'TION (Lat. *fumigatio*, from *fumus*, smoke), the cleansing or medicating of the air of an apartment by means of vapors, employed chiefly for the purpose of detaching infectious poisons from clothing, furniture, etc. See CONTAGION, INFECTION. Most of the methods of F formerly employed have little real value, and are to be looked on chiefly as grateful to the senses; as, for instance, the burning of frankincense, camphor, etc. The really active processes are noticed under the article DISINFECTANTS.

FUNA'RIA, a genus of mosses, with terminal fruit-stalks, and oblique double peristome, both the inner and outer having sixteen teeth. A few species are found in Britain, one of which, *F. hygrometrica*, is an object of particular interest on account of the hygrometric properties of its fruit-stalk, which, if moistened in the lower part, twists several times round in one direction; and if moisted in the upper part, twists several times round in the opposite direction. This is owing to a peculiar arrangement of the cellular tissue, which is spiral in one direction at the base of the stalk, then straight, then spiral in the opposite direction. The structure of the fruit-stalk has been closely examined and commented on by Dr. Lankester (*Annals of Nat. Hist.* vol. iv.). *F. hygrometrica* has very concave, ovate, entire, apiculate leaves. It is very common on old buildings and on dry barren soils; and is said to be almost always found where a wood fire has been burning on the ground, as on the site of gypsies' encampments, etc.

FUNCHAL', the capital and the only t. of the island of Madeira (q.v.), is situated on the s. side of the island, and consists chiefly of one street, extending for about a mile along the shore, and of numerous streets and lanes at right angles with the main street, and leading up the hill which backs the town. Its roadstead is open, and its anchorage rocky and uneven. F. has a cathedral, numerous churches, and small convents, and is defended by four forts. From it all the produce of the island is exported. Pop. 30,000.

FUNCTIONS, a mathematical term. When two or more variables are combined with constants in an equation, and are such that a change of value of one implies a corresponding change of value of one or more of the others, then such variables are said to depend on and to be F of each other; and the expression of the mode of dependence is said to be a *function* of such variables. If such an expression involves but one variable, it is said to be a function of one variable; if two are involved, to be a function of two variables; and so on. Thus $\sin x$, e^{ax}, $\log. x$, $\sqrt{a^2-x^2}$ are F. of one variable—viz. of x; e^{ax+by}, $\tan(ax+by)$, x^y, are F of two variables, x and y; so xyz, $x^2+y^2+z^2$ are F. of three variables, and so on. F. are denoted by the symbols F, f, φ, ψ, etc. Thus F(x) means a function of one variable, x combined with constants or not, as the case may be: $\psi(xyz)$ a function of three variables. These functional symbols are *general*, and their specific forms are the particular F which arise from operations in algebra, trigonometry, etc.

F. are implicit or explicit. When one variable is expressed in terms of others, it is said to be an explicit function of them; but when all the variables remain involved in one expression, the function is said to be implicit. Thus, $x^2+y^2-r^2=0$ is an implicit function of two variables, but $y=\sqrt{r^2-x^2}$ is an explicit function of one variable. In explicit F., the variable which is expressed in terms of the others is called the *dependent* variable, and the others the *independent* variables. Explicit F. are usually written in the form $z=f(xy)$; implicit in the form $u=F(xyz)=0$. F., again, are algebraical or transcendental. Algebraical F. are those which involve the operations of addition,

subtraction, etc., and of involution and evolution. Transcendental F. are those where the operations symbolized are such as e^x, $\log_e x$, $\sin x$, etc.—i.e., exponential, logarithmic, or circular. F., also, are simple or compound according as they involve one or several operations. $y = \sin x$ is a simple function; but $y = \log. \sin x$ is compound. Further, F. are divided into the continuous and the discontinuous, the circulating and the periodic. Continuous F. are such as are subject to the following conditions: 1. As the variable gradually changes, the function must gradually change; 2. The law symbolized by the functional character must not abruptly change. Circulating F. are those whose values lie within certain limits for all values of the variables. $y = \sin x$ is an example at once of a continuous and of a circulating function. A function is said to be periodic when it takes the form $f^n(x) = x$, signifying that if on x the operation f be performed n times, the resulting value will be x. Thus, $f(x) = \frac{1}{1-x}$ is a periodic function of the third order. For performing the operation indicated by f the second time on $\frac{1}{1-x}$ as the variable, we have $f^2(x) = \cfrac{1}{1 - \cfrac{1}{1-x}} = -\frac{1-x}{x}$; and the third time we have $f^3(x) = \cfrac{1}{1 - \left(\cfrac{1-x}{x}\right)} = x$. The functional calculus is a recent growth of the transcendental analysis. The object of the differential calculus (q.v.) is generally to ascertain the changes in F. arising from the continuous and infinitesimal variation of their subject variables. The object of the new functional calculus is, speaking generally, to investigate the forms of F. and their growth, when they are subject to a continuous and infinitesimal change as to form. According to Mr. Price (treatise on the infinitesimal calculus), as the differential calculus investigates properties of continuous numbers, so does the new calculus the properties of continuous F.; and as there is an integral calculus of numbers, so there is an inverse calculus of functions. Of the new calculus, the calculus of variations (q.v.) may be considered the main branch. It includes, of course, the subject of functional equations. Functional equations are those in which it is required to determine from equations the forms of F. entering them: e.g., what is the function of x and y which satisfies the equation $f(x) \times f(y) = f(x+y)$? See article CALCULUS OF FUNCTIONS in the *Encyclopædia Metropolitana*.

FUNCTUS OFFICIO, a phrase applied to something which, having formerly had vitality and force, is without any function to be discharged. When an agent or officer has fulfilled the duty assigned him, his office is *functus officio*. The same is true of legal papers which have been duly executed, and on which a judgment of court has been entered.

FUNDAMENTAL BASS, in music, is the root or fundamental note of the harmony. See HARMONY.

FUND, SINKING, a plan pursued for a considerable period for the purpose of collecting money for the payment of the national debt of Great Britain. It was begun in 1716 by sir Robert Walpole. Certain taxes which had previously been laid on for limited periods were then rendered perpetual, for the purpose of paying the interest of the funded debt. They prohuced more than enough for this purpose, and the surplus was laid aside, that it might accumulate into a fund for extinguishing the debt. It appeared to operate well, since, in 1728, after it had existed for 12 years, debt was wiped off to the extent of £6,648,000. It was not observed that, during the wiping off, new debt had been created to about the same extent, so that the nation was just in the position in which it would have been had it neither borrowed nor repaid. It is supposed that sir Robert may have seen the fallacy of the sinking fund, since in 1732 he took half a million from it to meet the expenditure of the year, instead of raising a new loan. It was in 1786, however, that the system was established on a great scale by the younger Pitt, who, notwithstanding his great practical abilities, was entirely misled by the theories of Dr. Price in his work on annuities. The system continued to be conducted on an enormous scale, until another student of economy and figures conclusively proved it to be useless; this was accomplished in 1813 by Dr. Hamilton, in his *Inquiry concerning the Rise and Progress, the Redemption and Present State, and the Management of the National Debt of Great Britain*. The fallacy which Dr. Hamilton showed to pervade a sinking fund may be best explained by a simple example. Suppose that one requires to borrow £100, and lays by £5 a year as a fund to pay it up with. Accumulating at compound interest, this fund will pay back the loan in about 15 years. The borrower will, however, gain no more by the process than if he paid the £5 a year to his creditor, for his debt would be diminishing to precisely the same extent as the fund to pay it off would be increasing. Suppose that while requiring only £100, the borrower raises £200, and lends out one of them, accumulating the interest until the whole amounts to £200; the borrower will no doubt be receiving interest on £100, but he will be at the same time paying interest on £200; and he would repay his debt at the same cost and with more simplicity if, instead of borrowing the second hundred at 5 per cent, he paid over £5 a year to his creditor. In these instances, nothing is lost by the sinking fund. But suppose that in the last case the creditor had agreed to lend the

£100 at 5 per cent, but in consideration of the greater risk, would not lend the £200 at less than 6 per cent, while the borrower can only get 5 per cent for the half which he relends—here the transaction would cause a dead loss of £2 a year over the plan of repaying by installments. This was exactly the case with the British sinking fund. The more money the chancellor of the exchequer wanted, the higher were the terms demanded by the lenders, and the addition to each loan for setting aside a sinking fund increased the rate of interest paid on it.

FUNDAMENTALS, in Christian Doctrine. I. Roman Catholic theologians give this name to those doctrines which, in their opinion, every Christian is obliged to know, believe, and profess, on pain of being lost; while non-fundamentals are such as a man may, involuntarily, be ignorant of, without forfeiting his Christian name and hope of salvation. Practically, according to the Roman view, whatever the church teaches is fundamental, and the terms of communion are the same as those of salvation. II. At the reformation, a similar distinction was introduced into the Lutheran church according to which the doctrines concerning Christ as the Mediator, and the word of God as the seed of truth, were placed among the truths necessary to salvation. III. All Christians consider certain truths as essential to the Christian system, and others as comparatively unessential. But here a distinction must be drawn between truths essential to Christianity as a system and the degree of knowledge concerning them essential to individual Christians in order that they may be saved. The former are as invariable as Christianity itself; the latter is as variable as the capacities and opportunities of men. In like manner the terms of communion may be very different from those of salvation. In Cromwell's time (1653) a committee of clergymen was appointed to draw up a catalogue of "fundamentals," to be reported to the parliament. Richard Baxter, who was one of the committee, proposed that the list should consist of the apostles' creed, the Lord's prayer and the ten commandments; but instead of these, 16 items were reported, including doctrines concerning God, Christ, divine worship, faith, sin, the resurrection, the judgment, everlasting life, and everlasting condemnation. On the whole, as concerns evangelical Protestant churches, it may be said that with, many specific points of difference in the statement of fundamentals in doctrine, there is a general agreement, and that this agreement is increasingly recognized.

FUND—FUNDING SYSTEM. Fund (Lat. *fundus*, ground, foundation) means a supply of money or a source whence money may be obtained. When we speak of "the funds" in this country, we mean that great organization for buying and selling the right to become a public creditor, and receive a share of the interest of the national debt. See Debt, National. When money has in this country been borrowed for public purposes, and it has been found that it cannot be repaid as a temporary loan, the resolution to hold it as a perpetual loan at a certain interest has been called "funding" it; and hence we read from time to time that certain obligations were converted from floating into funded debts.

FUNDI, or Fundungi, *Paspalum exile*, a kind of grain much cultivated in the w. of Africa. It is allied to the millets, and still more nearly to some of the kinds of grain cultivated in India. See Paspalum. It is wholesome and nutritious, and has been recommended to attention in Britain as a light and delicate food for invalids. The natives of western Africa throw it into boiling water, pour off the water, and add palm-oil, butter, or milk. By Europeans and negroes in Sierra Leone, it is much used with stewed meat, and sometimes made into porridge with milk.

FUNDY, Bay of, an arm of the Atlantic, separates Nova Scotia from New Brunswick and the state of Maine. With an average breadth of 35 m., it extends 180 m. in length from n.e. to s.w. It forks, at its head, into two inlets, the northern, called Chignecto bay, and the southern, Minas channel, which are divided by narrow necks of land from the gulf of St. Lawrence. Along its n.w. side, reckoning downwards, it receives the St. John, which is the principal river of New Brunswick, and the St. Croix, which, through its entire course, forms the international boundary. The navigation is rendered perilous by the peculiarity of the tides, which are said to rise and fall fully 70 feet.

FÜNEN. See Führen. *ante*.

FUNERAL EXPENSES, in law. If limited to the degree and quality of the deceased, F. E. are a privileged debt, allowed before all other debts and charges, both in England (3 *Inst.* 202) and in Scotland (Stair, iv. 35, 3). If the parties primarily liable neglect the duty of giving decent burial to the dead, a stranger may do so, and claim reimbursement out of his effects before all others having right, whether heirs or executors; yet this was not clear until very recently in the law of England. There is no fixed sum allowed in English practice, but if one dies in debt, it is usual to restrict the F. E. to £10. As against legatees, more liberal sums are allowed. In Scotland it is held (Buchanan *v.* Ferrier, Feb. 14, 1822) that mourning for the widow and such of the children of the deceased as were present at the funeral is a valid charge; but the reverse is the case in England, it having been decided (Johnson *v.* Baker, 2 C. and P. 207) that the widow has no claim for mournings either against the executor or the creditors of her husband. All along there seems to have been rather greater liberality in this matter

in Scotland than in England, where lord Holt held that nothing was allowable against a creditor except for the coffin, ringing the bell, parson and clerk (1 Salk. 296).

FUNERAL RITES. The methods of disposing of the dead have been so various and connected with so many ceremonial observances dictated by affection, religious conviction, or superstition, that a full consideration of the subject would occupy a volume. Under the article BURIAL will be found a description of the principal modes of interment, and the accompanying F. R. of the ancients.

With the spread of Christianity came the decorous interring of the dead with religious ceremonials indicative of hopes of a blessed resurrection. From the moment of death until interment, the body is the object of solemn ceremonial in the Roman Catholic church. At death, a crucifix is placed in the hand, or at the feet, and holy-water is sprinkled. The chief funeral rites are solemnized in the church, into which the coffin is borne and placed on a bier. Throughout France, the Netherlands, and continental Europe generally, the ordinary cortège of a funeral is a hearse with a bier, on which is the coffin, covered with a pall, followed by carriages all in black, with black horses. The same arrangement is pursued in England, but the hearse, sometimes over-decorated with dark plumes, is closed instead of being open. In the more common class of funerals, the coffin, shrouded in a pall, is borne on spokes, or on the shoulders of bearers. All the attendants are in black. A certain etiquette as to pall-bearers (parties who hold ribbons attached to the pall) is observed; the relatives of the deceased taking their place nearest the head in the degree of consanguinity, and the same arrangement is maintained in lowering the coffin by cords into the grave. Only in exceptional cases are bodies put in leaden coffins and deposited in vaults; the common sense of the people now appreciating the propriety of allowing corpses to dissolve and mingle with the earth of the grave; and for this practice the numerous new cemeteries offer facilities. Scottish Presbyterians, as is the case with some English dissenters, have no funeral service, unless we reckon as such a prayer, and occasionally the reading of a chapter of Scripture, by a clergyman before the body is borne from the house; but in other respects the Scottish ceremonial differs little from the English. Formerly, in the case of important personages, the hearse was preceded by a class of undertaker's men to clear the way, designated *saulies*, and gumpheon-men—these last bearing a pole shrouded at the top with black silk, called a gumpheon (*gonfalone*, a banner), being a relic of an ancient heraldic ceremonial; but this custom has nearly, if not altogether, disappeared. At Scotch funerals, the relatives, and in some cases the friends of the deceased, wear white cambric *weepers* at the wrists. Till within the present century, there was a practice of giving a series of expensive entertainments to guests at Scottish funerals, beginning with the *lykwake*, and ending with the *dredgy* (dirge); but all this is gone, or nearly so. The giving of costly entertainments was not, however, confined to Scotland or to Ireland. Taking its rise in ancient customs which were perpetuated by the Anglo-Saxons, the practice of consuming meat and drink in a species of gloomy festivity at funerals was common in England, and carried to an extravagant length at the decease of persons of distinction, on which occasion doles (q.v.) were also given. It had even its counterpart in the usages of the ancients. The *nekrodeipnon*, or funeral-banquet, is mentioned by Lucian and Cicero. It was always celebrated in the house of the nearest relative of the deceased, and Demosthenes, the patriot orator of Greece, tells us in his oration, *On the Crown*, that the relatives of those who were slain at Chaeroneia, were entertained by him in his own mansion, as if he were the nearest kinsman of the fallen heroes. The *nekrodeipnon* is often represented on funeral monuments. For some curious information respecting old funeral entertainments, we refer to Brand's *Popular Antiquities*, edited by Ellis. Without losing as regards decorum, funeral arrangements have been greatly cheapened in most large towns in England and Scotland by means of funeral-conducting establishments belonging to societies or private speculators. W. C.

FÜNFHAUS, FÜNFHÄUSEL, or HANGENDENLISSEN, a t. of Austria, in the circle of Unt, about 2 m. n. from Vienna, of which it is a suburb. It has silk, satin, woolen, cotton, and red leather manufactures. Pop. '69, 27,065.

FÜNFKIRCHEN ("Five Churches;" Hungarian, *Pecs*), an important t. of Hungary, capital of the co. of Baranya, is situated on the southern slope of the Mecseg mountains, near the Slavonian boundary, 105 m. s.s.w. of Pesth. It is the seat of a bishop, and is one of the oldest, as well as one of the most pleasantly situated and beautiful towns of Hungary. It formerly possessed a university. The most important of its buildings are the large and imposing cathedral, the bishop's palace, an Italian structure, the town-house, lyceum, gymnasium, seminary, and the churches, which are numerous and beautiful. It has important tanneries, woolen and flannel weaving and silks-pinning; produces wine, fruit, and tobacco, has coal-mines and iron-works, and a flourishing trade in hogs and gall-nuts. Pop. '69, 23,863.

FUNGI, an order of acotyledonous or cryptogamous plants, containing a very great number of species, nearly 5,000 being known, whilst it is probable that the whole number existing is very much greater. They are amongst the lowest forms of vegetable life, and some naturalists of no mean reputation have entertained the notion that they spring into existence in certain circumstances, not from germs previously existing, but from a mucus capable of organization, or through changes in the cells of more highly organized plants,

and of animals in states of disease or of decay; an opinion which, however, is more generally rejected as having no foundation in accurate observation, as not necessary to explain the readiness which certain F. almost invariably spring up in certain circumstances—from which is derived the chief argument in its favor, as opposed to all analogy of ascertained facts, and as rendered improbable by the abundant provision which all the F. possess for the perpetuation and diffusion of the species. F. are cellular plants, the cells sometimes elongated so as to become filaments. They consist of a *thallus*, which spreads in a matrix, and is nourished by it, and from which stems are thrown up into the air, bearing the fructification. The organs connected with fructification are often the principal part of F., and the thallus very small, consisting of a few cottony threads, or closely compacted cells, or even altogether undiscernible. Not unfrequently, however, the proportion of the thallus is comparatively great, and in circumstances unfavorable to the development of the organs of fructification, it extends itself greatly in the matrix, as in the case of dry rot, ergot, etc. (q.v.), and even of the common mushroom. The thallus of F. is called *mycelium* (Gr. *mykes*, a mushroom), and in mushrooms and some other kinds is further popularly known as the *spawn*. F. are nearly related to algæ and to lichens, but differ from both in deriving their nourishment from the earth or from the bodies upon which they grow, not from the medium by which they are surrounded. They differ also from lichens in their generally much softer substance and their fugacious character; also in being quite destitute of green granules (*gonidia*) in the thallus, which are characteristic of that order. They differ from algæ in not living immersed in water or other liquid, but producing their fructification in air. The lowest forms of F., and the lowest forms of algæ, are sometimes, however, not easily distinguished; and the mycelium of some F. is capable of spreading in a liquid, and assuming a modified appearance extremely resembling that of some algæ. It is supposed to be the presence of the *mycelium* of certain F. which makes liquors "mothery;" and to a similar cause is ascribed the ropiness of the dough in some bakehouses, an evil not easily cured.—From other plants in general, F. differ in their chemical composition, which is remarkably nitrogenous, and assimilates them to animal organisms; whilst, unlike other plants, they do not absorb carbonic acid from the air, and give out oxygen, but, like animals, absorb oxygen, and give out carbonic acid; so that some naturalists have proposed to constitute for them a distinct kingdom of nature intermediate between the animal and the vegetable.

F. are very various in size, many being scarcely visible without a microscope, whilst others are some feet in diameter. Even the same species, however, often exhibits great variety, not only in size, but in other particulars, according to the different circumstances of its growth, causing great difficulty to the botanist, whilst further difficulty arises from the modifications of imperfectly developed mycelium, of which many spurious genera have been constituted. A great resemblance in general appearance to F. is sometimes exhibited by diseased portions of leaves, etc., and by the secretions caused by the attacks of insects.—When the spore (seed) of a fungus germinates, it sends out radiating filaments, which generally branch and interlace, and portions of this mycelium removed to another favorable situation, grow there, so that F. are propagated by this means as higher plants are propagated by their tubers or by the division of their roots. The F. of simplest structure or lowest organization consist of nothing more, when they have reached their fullest development, than masses of spheroidal cells, spores, breaking up into a fine powder, as in some of the small parasitic species which are very injurious to corn. Sometimes these cells are united into jointed threads. In species of rather higher organization, the plant consists of jointed threads, but the spores are formed in the enlarged terminal joints, and are dispersed by their bursting. In the higher kinds, the spores are produced in or on peculiar organs of extremely various shape and character. In some, as puff-balls, the whole interior of the plant is filled with the fructification. In agarics, boleti, morels, etc., the fructification takes place on a particular membrane, a part of the external surface of the plant called the *hymenium*, variously situated (in agarics on the under side of the *pileus* or cap), the extent of which is often greatly increased by wrinkles, plates or *gills*, pits, pores, etc. These form the highest division of F., called *hymenomycetes*, in the system of Fries, the greatest continental authority in mycology, as this department of botany is sometimes termed. Berkeley, who, without any near rival, occupies the first place among the mycologists of Britain, divides F. into two "classes;" the first class not having the spores inclosed in tubular sacs (*asci*) or vesicles, and containing the "orders" *hymenomycetes* (agarics, boleti, etc.), *gasteromycetes* (puff-balls, etc.), *coniomycetes* (rust, smut, etc.), *hyphomycetes* (mold, mildew, *botritis*, *oidium*, etc.); the second class containing two orders, *ascomycetes* (morels, truffles, etc.), in which the spores are definitely arranged in *asci*, and *physomycetes* (some kinds of mold, plants which grow on fermenting substances, and some of the minute pests of cultivated plants), in which the spores are in vesicles without definite arrangement.

F. generally grow in damp situations, but there are many which occur chiefly on dry soils or on dry substances; and some appear in their greatest perfection in the finest summer weather, although many are most abundant in the colder and moister seasons of the year. It has been commonly asserted that they abound more in the colder parts of the world than within the tropics, but it is not improbable that this opinion has its

origin merely in imperfect observation of tropical species. The extreme rapidity of their growth, the briefness of their whole existence, the readiness with which they pass into decomposition, and the difficulty of preserving most of them in a form fit for examination, have been great obstacles to their scientific study. It is known, however, that some species are of very wide geographic distribution, whilst others are comparatively very limited. Some species grow in earth, others in various kinds of putrescent or fermenting animal or vegetable matter, many in decaying parts of trees or on dead wood, others on diseased animal and vegetable tissues, etc. It appears to be the office of many of them to hasten the decomposition of animal, and more particularly of vegetable substances. Some of the minute kinds appear to be the cause of disease in the higher kinds of plants which they attack, and are formidable to the farmer and the gardener. Some are in like manner destructive to animal life, as in the case of the muscardine (q.v.) or silk-worm rot, and certain species of *sphæria* which grow from living caterpillars. See Entophytes.

Some F. are remarkably phosphorescent. Thus the undeveloped mycelium of some kind produces a very beautiful luminosity in some German coal-mines; and a species of agaric (*agaricus gardneri*), growing on palms in Brazil, shines brightly in the night. *Agaricus olearius*, a native of the s. of Europe, is also luminous.

The chemical examination of F. yields in large quantity a substance called fungine, which, however, is now regarded as consisting of cellulose and fatty matter, several other nitrogenous substances, an acid called *fungic acid*, a kind of sugar, etc. The poisonous properties of some are ascribed to an alkaloid called *amanitine*. Others appear to owe their poisonous character to an acrid volatile substance. Many of the smaller F. are important because of the injury which they cause to crops, timber, etc. A few species are used in medicine, of which the only one really important is ergot of rye. One or two are used as tinder (see Amadou), moxa (q.v.), etc. The smoke produced by burning the dust (spores) of ripened puff-balls has anæsthetic properties, and is used for stupefying bees. *Polyporus squamosus* cut into slices makes the best of razor-strops. But the chief economical use of F. is for food, and in the manufacture of the sauce called ketchup (q.v.).

Edible Fungi.—Many fungi of the sub-orders *hymenomycetes*, *gasteromycetes*, and *ascomycetes* are edible; and some of them are much esteemed as delicacies, whilst in many countries they constitute an important part of the food of the people. In Britain, very few are used, many of those species which are most esteemed on the continent of Europe being utterly disregarded, and indeed classed in popular estimation with toad-stools as poisonous. The truth appears to be, not that the greater number are poisonous, and only a few edible, but that the noxious species are comparatively few, the principal danger arising from the similarity of some of the poisonous and some of the edible agarics, and from the liability of some of the edible species to acquire poisonous properties in particular situations and circumstances. This is notably the case with the common mushroom (*agaricus campestris*), which is far more generally used in Britain than any other edible fungus, but of which some varieties are unsafe, apparently in consequence of the circumstances of their growth. From the markets of Rome, and other cities of Italy, where numerous species of fungi are extensively sold, this species is rigorously excluded. So important an article of food are F. in Italy, that in the market of Rome alone they are supposed to be sold to the value of about £4,000 a year. For weeks, both in spring and in autumn, F. form the principal and almost the sole food of multitudes of the poor in Italy, Germany, and France; and besides those which are eaten fresh, great quantities are used dried or preserved in oil, vinegar, or brine. The soaking of F. in vinegar or brine takes away the acrid qualities of some which are dangerous when fresh, and renders them perfectly safe. So valuable are F. esteemed, that some species are frequently cultivated. The cultivation of the common mushroom (q.v.) is familiar to us in Britain, but other species of *agaricus*, *boletus*, etc., are plentifully raised in some parts of the continent of Europe, by watering the ground in places appropriate for them with water in which mature plants abounding in spores have been bruised; others are obtained by merely placing in favorable circumstances substances in which their spores are already contained. Thus, a species of *polyporus*, much esteemed, is procured in Italy by moistening the porous stone (Ital., *Pietra funghaia*) over which a little earth has been scattered; another species of *polyporus*, by slightly charring and then watering blocks of the wood of the common hazel; a species of *agaricus*, by cutting off and then watering the heads of black poplar trees; and another *agaricus*, by placing the grounds of coffee in circumstances favorable for its growth.

It is a common notion, but utterly destitute of foundation, that dangerous F. may be distinguished from those which it is safe to eat by their discoloring a silver spoon if they are stirred with it whilst they are being cooked. Nor is greater dependence to be placed on the rule that the more readily deliquescent F. are poisonous; nor on peculiarities of color of the flesh or juice, except in so far as these characters may avail for the discrimination of particular species, the qualities of which are known. The edible F. have generally an agreeable smell and taste, whilst some of the poisonous kinds are offensive both to the nostrils and the palate, but no trustworthy general rule can be laid down on these points; and some of those which are very pungent and acrid

when raw, become bland and wholesome when cooked, their acridity being dissipated by heat.

Among the most important edible fungi are:

Hymenomycetes.—The common mushroom, champignon, and numerous other agarics and fungi closely allied to true agarics, as species of *cortinaria cantharellus*, etc. These will be noticed in the article MUSHROOM.

A number of species of *boletus* (q.v.), and of *polyporus.* See AMADOU. *Fistulina hepatica.* See FISTULINA. Several specimens of hydnum (q.v.). Several species of *clavaria*, some of which are found in Britain; beautiful F., with a thickish stem which divides into numerous small branches. It is said that all the species of this genus are esculent, although some are very superior to the rest in flavor and delicacy. One species (*C. flava*) is popularly known in Germany as *ziegenbart* or goat's-beard. They grow on the ground in woods and pastures.

Gasteromycetes.—Different kinds of puff-ball (q.v.), in a young state, and whilst still fleshy throughout.

Ascomycetes.—Different species of morel (q.v.), *helvella* (q.v.), *verpa*, *peziza*, etc. The common truffle (q.v.), and allied species. *Cyttaria Darwinii*, which grows on living branches of South American beeches, and forms a principal part of the food of the natives of Terra del Fuego during some months of the year.

"It is a curious fact that the poisonous properties of mushrooms vary with climate, and probably with the season of the year at which they are gathered. Another circumstance deserving of notice is, that by idiosyncrasy some individuals are liable to be seriously affected even by those species which are usually regarded as innocent. Some species which are poisonous in this country, are used freely by the Russians; it appears they are in the habit of salting, boiling, and compressing them before they are eaten; and this may in some instances suffice to account for their having no noxious effects.

"*Symptoms and Effects.*—The noxious species of mushrooms act sometimes as narcotics, at others as irritants. It would appear from the reports of several cases, that when the narcotic symptoms are excited, they come on soon after the meal at which the mushrooms have been eaten, and that they are chiefly manifested by giddiness, dimness of sight, and debility. The person appears as if intoxicated, and there are singular illusions of sense. Spasms and convulsions have been occasionally witnessed among the symptoms when the case has proved fatal. In some instances, the symptoms of poisoning have not commenced until thirty hours after the meal; and in these, narcotism followed the symptoms of irritation. It might be supposed that these variable effects were due to different properties in the mushrooms, but the same F. have acted on members of the same family, in one case like irritants, and in another like narcotics. In most cases, recovery takes place, especially if vomiting be early induced. In the few instances which have proved fatal, there has been greater or less inflammation in the stomach and bowels, with congestion of the vessels of the brain.

"*Treatment.*—The free use of emetics and castor oil."—Taylor *On Poisons.*

See Dr. Badham's *Treatise on the Esculent Funguses of Great Britain;* and *Fungi*, by M. C. Cooke, edited by Rev. M. J. Berkeley (1875).

FUNGIBLES. In the law of Rome, the contract of loan was divided into *mutuum* and *commodatum*, a division which has been adopted by the law of Scotland, and by most of the continental systems which are founded on the civil law. The former had reference to objects which admitted of being estimated by weight, measure, or number, or which could not be used without being given away or consumed. These objects, consisting of money, corn, wine, oil, and the like, could be used only by him who possessed the full right of ownership, and consequently the contract of *mutuum* transferred the ownership to the borrower, who became bound to return, not the object borrowed, but its equivalent. Objects of this nature, from the fact that they were got rid of one for another (*funguntur*), were called fungibles. The other class of movable objects, again, to which the Roman contract of *commodatum*, or hire, properly so called, applied, were transferred to the borrower on condition that he should return the same individual objects to the lender.

FUNGUS (Lat. a mushroom) is a term applied in pathology and surgery with several significations. Thus, any excrescence from a surface of skin, or mucous membrane, or even from deeper parts, is sometimes called a F., more especially if it have a soft mushroom-like character, and a broad short pedicle. When the pedicle is long and narrow, it is called polypus (q.v.). The growths to which the term F. is chiefly applied are those which have the characters of cancer (q.v.); especially *fungus hæmatōdes*, a very dangerous variety. But F. has yet another application in pathology, to those minute incrustations and alterations of the skin which are dependent upon the growth of vegetable parasites, as favus, ringworm (q.v.), etc.

FUNNEL, a conical vessel terminating in a tube, and used for pouring liquids into narrow-mouthed vessels, and in laboratories for filtering. See FILTER. For common purposes, they are made of tin-plate or copper, but when for corrosive liquids, they are made of glass or earthenware. In some parts of Great Britain, as in the midland counties of England, a F. is called a "tun-dish;" in other parts, a "filler."

FUNNEL (Lat. *fundo*, to pour), in steam-vessels, is the iron tube designed to convey away above the deck the smoke and gases set at liberty during the combustion of fuel in the boiler-flues, and also, from its height, to afford a sufficient draught to the furnaces. In large ships, the F. is of great size; and in men-of-war, usually telescopic, so that, by simple mechanism, it may be withdrawn during an action from the chance of injury by cannon-shot.

FUR is the term applied to the incrustation which is formed in the interior of vessels (tea-kettles, boilers of steam engines, etc.) when calcareous water has been for a considerable time boiled in them. Many spring waters contain carbonate of lime held in solution by carbonic acid. When this water is boiled, the acid is expelled, and the carbonate is deposited, often in association with a little sulphate, forming a lining more or less coherent upon the sides of the vessel. In steam-boilers, this may be prevented by the addition of a small quantity of sal-ammoniac (hydrochlorate of ammonia) to the water; double decomposition takes place, carbonate of ammonia being formed and volatilized, while chloride of calcium remains in solution.

FURCA, a mountain in the canton of Valais, Switzerland, w. of St. Gothard; more than 8,000 ft. high.

FURETIÈRE, ANTOINE, 1620–88; best known as the author of a dictionary of the French language. He practiced for a time as an advocate, but finally entered the church and became abbe of Chalivoy. In his leisure he devoted himself to letters, and in virtue of his satires—*Nouvelle Allégorique ou Histoire des deniers troubles arrivés au Voyaume d' éloquence; voyage de Mercure*, etc.—he was admitted a member of the French academy in 1662. That learned body had long promised the world a complete dictionary of the French tongue; and when they heard that F. was on the point of issuing a work of a similar nature, they interfered, alleging that he had purloined from their stores, and that they possessed the exclusive privilege of publishing such a book. After much bitter recrimination on both sides, the offender was expelled in 1685; but for this act of injustice, he took a severe revenge in his satire, *Couches de l'Académie*. The reply which he made to the academician Charpentier, entitled *Factums*, ran through four editions. His dictionary was published at Rotterdam two years after his death. Revised and improved by Basnage, it was issued in 1701, and again in 1725; and continued to enjoy a high reputation till the appearance of *Dictionnaire de Trévoux*, for which, indeed, it furnished the basis. Furetière's other works do not possess any great literary merit; but one of them, *Le Roman Bourgeois*, is of interest as descriptive of the every-day life of his times.

FURFU'RAMIDE, FUR'FURINE, and FUR'FUROL. When starch, sugar, or bran is acted upon by dilute sulphuric acid and peroxide of manganese, the distillate contains not only formic acid (q.v.), but a small quantity of an essential oil, which, after being purified by redistillation, is colorless, has a fragrant odor somewhat resembling that of bitter almonds, and when dissolved in cold sulphuric acid, forms a beautiful purple liquid. This oil is termed furfurol, and its composition is represented by the formula $C_{10}H_4O_4$.

If furfurol be treated with ammonia, it is converted into furfuramide ($C_{30}H_{12}N_2O_6$), which occurs in colorless crystals, insoluble in water, but soluble in alcohol, and perfectly neutral.

If furfuramide is boiled with a solution of potash, it dissolves, its elements assume a new arrangement, and the solution on cooling deposits long silky needles of a powerfully alkaline base, furfurine, which is isomeric with furfuramide. It is dissolved by dilute acids, and completely neutralizes them; and on adding ammonia to these solutions, the alkaloid is precipitated unchanged. It was discovered by the late prof. Fownes; and as the first vegeto-alkali artificially formed, its production was regarded as a great step in organic chemistry.

FUR AND FURRIERY. The skins of animals, having hair or fur as a coating, have been used in Europe as an article of clothing for many centuries. Since European countries, however, have become more and more cleared and inhabited, fur-bearing animals have nearly disappeared; and the supply is now chiefly obtained from other regions, especially North America.

All the chief fur-bearing animals will be found described under their proper headings: we shall do little more here than barely enumerate them. *Ermine* fur is of a pure white, except the tip of the tail, which is black. The spotted appearance of this fur is not natural; it is produced by sewing the black tail-tips on the white fur at certain spots. *Stoat* fur is a kind of inferior ermine. *Sable* fur, obtained chiefly from northern Russia and Siberia, is valued in proportion to the darkness of its color. *Marten* fur, especially that of a rich dark-brown olive color, is much sought for. *Fiery-fox* fur, brought chiefly from the north-eastern part of Asia, is admired both for its brilliant fiery color and for its fineness. *Red-fox* fur, differing in some particulars from the kind just named, is much sought after by the Chinese for trimmings, linings, and robes. *Silver-fox* fur has a peculiar lustrous silver-gray color. *Nutria* fur, belonging to the animal called the *coypou*, is brought largely from South America, chiefly as a chief substitute for beaver. *Sea-otter* fur has been known in Europe about a century and a half,

being obtained from the otters which frequent the seas washing the Asiatic shores of the Russian dominions; it varies from a beautiful brown to jet-black, and is very fine, soft, and glossy. *Seal* fur is obtained from the seals frequenting various coasts, chiefly in the Southern ocean. *Beaver* fur was once much in request for the manufacture of hats; but the growing scarcity of the animal, and the substitution of silk hats for beaver hats, has lessened its importance. The fur of various other animals is similarly valued, either for its warmth or its beauty; such as that of the *bear, raccoon, badger, minx, lynx, musquash* or *musk-rat, rabbit, hare, squirrel,* and *chinchilla.*

For manufacturing purposes, furs are classified into *felted* and *dressed.* Felted furs, such as beaver, nutria, hare, and rabbit, are used for hats and other felted fabrics, in which the hairs or filaments are made so to interlace or entangle as to form a very strong and close plexus. The quality of the fur is better when the skin is taken from the animal in winter than in any other season, giving rise to the distinction between "seasoned" and "unseasoned" skins. The removal of the fur from the pelt is a necessary preliminary to the preparation of fur for felting purposes. In many kinds of skin, such as that of the hare, the fur is of two kinds—a close short layer of felting fur next the pelt, and longer outer hairs of unfelting fur. The removal of these two is effected separately. The long hairs are cut off by a kind of shears; and the true fur is then removed by the action of a knife, bearing some resemblance to a cheese-cutter, requiring much care in its management. In some sorts of skin, the long hairs are removed by pulling instead of shearing; in others, the greasiness of the pelt renders necessary a cleansing process before the shearing can be conducted, with the aid of soap and boiling water; and in others, both pelt and fur are so full of grease as to require many repetitions of cleansing. For beaver skins, a machine of very beautiful construction is employed in cutting the fur from the pelt. When the coarse hairs have been removed to form a stuffing for cushions, the skin is placed in a machine containing a broad keen blade equal in length to the width of the skin. This blade has a peculiar reciprocating movement given to it, producing a kind of chopping effect on any substance to which it is applied, by coming nearly in contact with another blade placed parallel with it. The skin is guided between rollers into the space between the two blades; and then the action of the upper blade crops off the fur from the pelt in a very complete manner—every particle being removed, and yet the pelt is not cut. The fur falls upon an endless apron, which carries it to a chest, or trunk, containing a blowing-machine; this machine separates the fur into three or four qualities, by blowing to the furthest distance the lightest and most valuable filaments, leaving the heavier and coarser to be deposited sooner.

Furs have their felting property sometimes increased by the process of *carroting,* in which the action of heat is combined with that of sulphuric acid. The chief employment of felted furs is described under HAT MANUFACTURE.

Dressed furs are those to which the art of the *furrier* is applied for making muffs, boas, and fur-trimmings to garments. The fur is not separated from the pelt for these purposes; the two are used together; and the pelt is converted into a kind of leather to fit it for being so employed. The fur-hunters always exercise great care in dyeing the skins after removing them from the animals, seeing that any putrefactive action would ruin the fur. When brought to England, the skins undergo certain cleansing processes. They are steeped and scoured in a bath of bran, alum, and salt, to remove greasiness from the pelt; and then in a bath of soap and soda, to remove oiliness from the fur. When thoroughly washed and dried, it is found that the pelt, by the action of the alum, has been converted into a kind of *tawed* or kid leather.

When the skins are cleansed and dried, they are made up into garments and trimmings by sewing through the pelt. The skins, however, are very irregular in shape, and often differ much in color in different parts; they require to be cut up into pieces, matched according to tint, and sewn together edge to edge. This requires much skill, especially where the furs are of a valuable sort. A fur garment or trimming, appearing to the eye as if it were one uniform piece, is thus generally made up of many curiously shaped pieces. The shaping for use, and the lining with silk and other materials, call for no description.—The great source of furs is the Hudson's Bay territory (q.v.).

FUR AND FURRIERY (*ante*). Trade in furs began with the first European settlements in North America, and beaver-skins were used in New Amsterdam and elsewhere in place of gold and silver for currency. The figure of a beaver is a conspicuous figure on the escutcheon of the city of New York. The search for furs was one of the objects of the daring expeditions of the voyagers of French Canada, as the search for gold was the motive power of Spanish invasion of Mexico and South America. The famous Hudson's bay company originated in 1670, and claimed the entire country from the bay to the Pacific and from the great lakes to the Arctic ocean, except such portions as were then occupied by Frenchmen and Russians. Towards the close of the 18th c., certain Canadian merchants formed the Northwest fur company, having their headquarters at Montreal, their operations being carried on in the districts watered by rivers that flow to the Pacific. This organization soon became a formidable competitor with the Hudson's bay company. In 1821, the two companies united. The charter expired some years

ago, and the once powerful organization is now a simple trading-company. In 1763, some merchants of New Orleans established a fur-trading post where St. Louis now stands, under the management of the brothers Chouteau For the first half of the present century the St. Louis trade was from $200,000 to $300,000 a year. One of the most famous of early American fur-traders was John Jacob Astor, of New York, who began by trading in a small way upon his arrival in the country in 1784. By 1810–12, his trade, conducted under the name of the American fur company, was enormous. An entirely new field for American enterprise was opened by the purchase of Alaska in 1867, which secured complete control of an important seal-fishery. This field was so eagerly worked that it was found necessary to limit the taking of seals to 100,000 per year, and those only to be males, lest the animals should be altogether exterminated. The annual value of the trade in Alaska alone is about $1,250,000.

Collectors and dealers in Canada and the United States forward their furs to the seaboard, chiefly to New York, for sale there, or for consignment principally to London and Leipsic. In the latter town, spring and autumn fairs are still maintained, at which every kind of wares are sold or exchanged with dealers from Turkey, Austria, and Russia. Nijni-Novgorod is the chief fair for European Russia, though very important fairs are also held in Kasan and in Irbit, among the Ural mountains. The most important fair for eastern Siberia is held at Kiachta, on the borders of China, where an extensive exchange of furs is carried on with the Chinese. Japan has entered very little into the fur trade, though her northern shores have furnished many fine fur-seals and sea-otters to the hardy navigator. Staple furs, or those used chiefly in the manufacture of hats, are those of the hare and the rabbit, collected mainly in Russia, Germany, France, and England; dressed, carroted, and cut from the skin in western Germany, France, Belgium, and England; and thence distributed to the manufacturing centers of the world; and here it may be added that the clippings and cuttings of fancy furs from the workshops of furriers are all saved, and find their way to the machinery which utilizes the waste and transforms them into hatters' furs. But of all these fur marts, that of London is the chief, for thither tends, by the laws of trade, not only much of the produce of Asia and Europe, but also the fine peltries of Chili and Peru, the nutria from Buenos Ayres, the fur-seal of Cape Horn and South Shetland, the hair-seal from Newfoundland, as well as the inferior peltries of Africa. To prepare fur skins in a way to endure this long transportation is a simple and easy matter. When stripped from the animal the flesh and fat are carefully removed, and the pelts hung in a cool place to dry and harden; nothing is added to protect them. Care is taken that they do not heat after packing, and that they are occasionally beaten to destroy worms. A marked exception is the case of the fur-seal, which is best preserved by liberal salting and packing in hogsheads. All other raw furs are marketed in bales.

Few kinds of animals furnish a pelt of suitable weight and pliability, and all of them differ widely in elegance of texture, delicacy of shade, and fineness of overhair; and these differences determine their place in the catalogue of merchandise. These few animals are not very prolific, and many of them attain their greatest beauty in wild and uncultivated regions. To this remark there are some notable exceptions; being thus few in kind, and limited in quantity, the extinction of the several choice varieties might be expected through the persistent energy of the trapper. But here the fickleness of fashion steps in, and does for the fur trade what the law of supply and demand does for the more staple articles of commerce. Fashion, fastidious and fickle, neglects the use of certain kinds for a season; the market price of the pelt no longer repays the outfit of the trapper; the hunt is intermitted, and in two or three years the animal regains its numbers and strength. The annual collection of furs is thus subject to ceaseless change; but the following may be relied on as an estimate correct enough for all practical purposes. [The table and the principal facts here given, are from *Encyc. Brit.*, 9th ed.]

AVERAGE ANNUAL COLLECTION.

Badger	America	5,000
"	Europe and Asia	50,000
Bear	America	15,000
"	Europe and Asia	4.000
Beaver	Asia	20,000
"	America	200.000
Buffalo	America	100.000
Chinchilla	Peru and Chili	100.000
Cat, Wild		10.000
" House		1,000,000
Ermine	Asia and Europe	400.000
Fisher	America	12.000
Fitch	Europe	600.000
Fox, Silver	Asia and America	2.000
" Cross	Asia and America	10.000
" Blue	Europe and America	7,000
" White	Arctic	75,000

Fox Red	Asia and Europe	300,000
" "	America	60,000
" Gray	America	30,000
" Kit	America	40,000
Hamster	Europe	200,000
Hare	Asia and Europe	4,500,000
Kolinsky	Asia	80.000
Lamb	Persian	100,000
"	Astrakhan	600,000
"	European	2,000,000
Lion		500
Lyme		50,000
Marten	America	130,000
" Stone	Europe	150,000
" Baum	Europe	60,000
" Russian Sable		100,000
Mink	America	250,000
"	Russia	50,000
Monkey	Africa	40,000
Musk-rat	America	3,000,000
"	Russia	100,000
Nutria	South America	3,000,000
Opossum	America	250,000
Otter, Land		40,000
" Sea	North Pacific	5,000
Rabbit	Europe	5,000,000
Raccoon	America	500,000
Seal, Hair	Atlantic	1,000,000
" Fur	Pacific	200,000
Skunk	America	350,000
Squirrel	Siberia	6,000,000
Tiger	Bengal and North China	500
Wolf		25,000
Wolverin		3,500

FÜRICH, JOSEPH VON, 1800–76; a painter and contemporary of Cornelius and Overbeck. His first attempt at composition was a sketch of the *Nativity* for the festival of Christmas in his father's house. He lived to see the day when, becoming celebrated as a composer of Scriptural episodes, his sacred subjects were transferred in numberless repetitions to the roadside churches of the Austrian state, where humble peasants thus learned to admire modern art, reviving the models of earlier ages. F. has been fairly described as a "Nazarene," a romantic religious artist whose pencil did more than any other to restore the old spirit of Dürer and give new shape to countless incidents of the Gospel and scriptural legends. He was a master of the art of arrangement, and in form, movement, and expression his power was considerable. His drapery, if peculiar, was perfectly cast. Endowed with creative genius, he lacked skill as a colorist. Among his well-known works are illustrations to the "Lord's Prayer;" the "Triumph of Christ;" the "Road to Bethlehem;" the "Succession of Christ according to Thomas à Kempis;" and the "Prodigal Son." The latter especially is remarkable for the constant recurrence of the allegorical spirit of evil. F. studied under Bengler in the academy of Prague in 1816. His earliest inspirations were derived from the prints of Dürer and the *Faust* of Cornelius. In 1834, he was made custos and in 1841 professor of composition in the academy at Vienna. In 1854–61, he produced the vast series of wall paintings which cover the inside of the Lerchenfeld church at Vienna. In 1872, he was pensioned and made a knight of the order of Franz Joseph.

FURIDPUR', a t. of Bengal proper, capital of a district of the same name, stands on the right bank of the Ganges, here called the Podda, in lat. 23° 36′ n., and long. 89° 50′ east. It is 115 m. to the n.e. of Calcutta. Excepting the public establishments, which it possesses as the capital of the district of its own name, the place is mainly a scattered series of native villages; and, in fact, it claims notice chiefly as having at one time been a nest of river-pirates. Pop. '72, 8,593.

FURIDPUR', or DACCA JELALPUR, the district mentioned in the preceding article, stretches in n. lat. between 23° 3′ and 24° 5′, and in e. long. between 89° 30′ and 90° 15′, containing 1496 sq.m. and (1872) 1,012,589 inhabitants. It is everywhere intersected by branches or feeders of the Ganges, which, as the surface barely rises above the level of the sea, are all, unless in the dry season, well adapted to navigation. The soil is in general rich; and the climate, more particularly from the beginning of Mar. to the middle of June, is excessively hot.

FURIES. See EUMENIDES.

FURLONG (the length of a furrow), a measure of length, the eighth part of a mile or 220 yards. See YARD.

FURLOUGH, a military term signifying leave of absence. Non-commissioned officers and private soldiers on F. must be provided with a pass, or they are liable to be seized and dealt with as deserters.

FURMAN, RICHARD, D.D., 1755–1825; b. N. Y.; removed when a child to South Carolina. At the age of 18, he became a Baptist minister, and was conspicuous for eloquence and patriotism during the revolution. Several of his discourses were published.

FURNACE, a contrivance for the production and utilization of heat, for warming, ventilating, cooking, and for manipulation of metals and liquids in the arts. Calcining furnaces are those in which the solid fuel is mixed with the matters to be heated. Crucible furnaces are used for melting steel or brass, and the F. itself is imbedded in the mass of heating fuel. Forge furnaces are such as are in ordinary use by blacksmiths, merely a combination of draft and blowing from a bellows. Blast and cupola furnaces are used in the smelting of iron and other ores, and the fusing of hard metals. In these the stuff to be melted and the fuel are charged in combination in the upper end of a vertical cylinder, and the combustion is produced by air forced in at the bottom. Flame furnaces are of varied form and character. Their effect is obtained by bringing a flame or current of highly heated gas into contact with the thing to be acted upon, instead of imbedding the substance with the fuel. The well-known reverberatory F., with fire-grate, flume-chamber, etc., is so arranged that by means of a low arched roof the flame is reverberated or turned back upon the material to be operated upon. Gas furnaces have recently come into use; there are five or six different kinds. There are furnaces for burning powdered fuel, for natural gas, and for petroleum, Furnaces are also very largely used in glass-making, and in metallurgy and iron-manufacture.

FURNAS, a co. in s. Nebraska, on the Kansas border, intersected by Republican river; 900 sq.m.; pop. 1550. The surface is undulating, with very little woodland. It is a grazing country. Co. seat, Beaver City.

FURNEAUX, the name of an English navigator, who was second in command on Cook's second voyage, indicates various localities in the southern hemisphere.—1. Furneaux island in the open Pacific, lies in lat. 17° s., and in long. 143° 6′ w.—2. Furneaux islands, an Australasian group in Bass's strait, between Australia and Tasmania. Flinders island, the principal one, is 46 m. long, by 10 broad; Cape Barren, Clarke, Hummock, and Babel islands are those next in importance. Flinders and Clarke islands have peaks 2,500 ft. above the sea. Their soil is sandy, and vegetation scanty.

FURNES, a small t. of Belgium, in the province of West Flanders, is situated in a marshy and unhealthy district, 4 m. from the sea, and 27 m. w.s.w. of Bruges. At this town four important lines of canal meet. F. is well built, has a town-house, a fine Gothic structure, richly ornamented with carvings, and has interesting remains of the former abbey of St. Willebrod. It has a great trade in horses, cattle, hops, and cheese; and has three annual fairs, at which large quantities of linen are sold. Pop. '70, 4,500.

FURNESS, WILLIAM HENRY, D.D., b. Boston, 1802; graduated at Harvard; studied theology at Cambridge, and was ordained pastor of the First Unitarian church in Philadelphia in 1825. A great part of his life has been devoted to the study of the life and spiritual ideas of the Savior, in pursuit of which he has published *Remarks on the Four Gospels; Jesus and His Biographers; History of Jesus; Thoughts on the Life and Character of Jesus of Nazareth; The Veil partly Lifted, and Jesus becoming Visible.* He has composed prayers, hymns, and other devotional works, and made translations of secular poetry from the German; besides contributing to current religious literature. He was also widely known in the long struggle with slavery as a supporter of the cause of freedom. His writings show an unusually refined spiritual sentiment.

FURNESS, WILLIAM HENRY, JR., 1828–67; b. Philadelphia, son of William Henry. He early turned his attention to art, and studied in various cities of Europe. He commenced his career as portrait-painter in Philadelphia, but soon afterwards removed to Boston, where he met with an exceptional success. Among his sitters were his father, Charles Sumner, Lucretia Mott, and many celebrities of the day. He was on the high-road to fame when he died at the age of 39.

FURNITURE, the name of an organ-stop or register, consisting of two or more ranks of pipes to each note, all of a higher pitch than the 15th stop.

FURNITURE (*ante*), the chattels and fittings required to adapt houses, churches, ships, etc. for use. The sculptures, paintings, and metal work of antiquity and of the later ages, now kept in museums and private collections, have, with few exceptions, formed part of decorations or furniture of temples, churches, or houses, Most of the ancient bronzes, are either images taken from ancient shrines, or pieces of mirrors, tripods, altar vessels, or even the dishes and pans of the kitchen. Wood, ivory, precious stones, bronze, silver, and gold have been used from the most ancient times in the construction, or for the decoration, of seats, chests, tables, and other furniture, and for the shrines and altars of sacred buildings. Most of the mediæval furniture, chests, seats, trays, etc., of Italian make, were richly gilt and painted, In northern Europe carved oak was more generally used. State seats in feudal halls were benches with ends carved

in tracery, backs paneled or hung with cloths, and canopies projecting above. Bedsteads were square frames, the testers of paneled wood, resting on carved posts. The splender of most feudal houses depended on pictorial tapestries which could be packed and carried from place to place in chests of carved oak or Italian cypress. Wardrobes were rooms fitted for the reception of dresses, as well as for spices and other valuable stores. Excellent carving in relief was executed on caskets which were of wood or of ivory, with painting and gilding, and decorated with delicate hinges and locks of metal work. The general subjects of sculpture were taken from legends of the saints or from metrical romances. Renaissance art made a great change in furniture, as in architecture. Cabinets and paneling took the outlines of palaces and temples, and curious internal fittings were arranged in cabinets, still following the details of architectural interiors. The elegance of form and perfection of detail, noticeable in the furniture of the 16th c., declined during the 17th all over Europe. The frame-work became bulky and heavy, and the details course. To this period belongs the name of André Charles Boule, who furnished the palace of Versailles. He invented or perfected a beautiful system of veneering with brass and tortoise-shell, or brass and ebony, occasionally using white metal besides. Examples of this buhl or boule are shown in the Apollo gallery of the Louvre at Paris. The system of veneering or coating common wood with slices of rare and costly woods, fastened down with glue by screw-presses, came into general use in the 18th century. Marquetry is veneer of different woods, forming a mosaic of pictorial or ornamental designs. Looking-glasses in large sheets exported from Venice at the end of the 17th c. were engraved with figures on the backs. The light fantastic frames which came into fashion in France were called "rococo" (from *roquaille*, *coquaille*, rock and shell work). Carved and gilt furniture was made in Italy, where it was best designed, and all over Europe, till late in the 18th century. The "empire" style, a stiff affected classicalism, prevailed in France during the reign of Napoleon. It is shown in the metal mounts of veneered mahogany furniture, and in the carvings of chair legs and backs.

A return has been made during recent years to mediæval designs. In England there is a revival of the fashions prevalent during the first fifty years of the last century. In France and America the elegant Louis XIV. style is very popular. Bedroom furniture is no longer as rich or costly as when it was the fashion to include state bed-chambers among suites of rooms thrown open for the entertainment of guests. Light-colored woods, with the simplest decorations, are preferred by many, on account of their freshness and cheerfulness. Common woods, such as pine, ash, oak, and maple, with French polish and with colored lines sparingly employed, are much in use for bedroom furniture, though less durable than mahogany. Imitations by graining are general, though not satisfactory; the practice was common even in ancient Rome. The Japanese have a method of staining, powdering with gold-dust, and polishing common wood without hiding the grain.

The designs of furniture in the United States vary greatly. Among the styles often seen are the Gothic, Florentine, Venetian, Roman, and Dutch, the classic and the *rococo*. The Eastlake style, now in favor, is by some critics disliked as exaggerated. Many manufacturers employ "furniture designers," frequently persons who have a high reputation for artistic work. Often the designs of the furniture are procured from the architect of the house, thus avoiding incongruities.

The census of 1870 reported 5,981 manufacturers of furniture, employing 53,298 persons; with a capital of $43,947,913; paying $21,574,531 as wages; using $25,843,170 worth of raw material, and manufacturing furniture to the amount of $69,082,684. [Principally from *Encyc. Brit.*, 9th ed.].

FURNITURE, Household. Hiring of. If a man lets out furniture for immediate use, there is an implied warranty that it is fit for use, and free from all defects inconsistent with the reasonable and beneficial enjoyment of it. Sutton *v.* Temple, 12; Meason and Welsby, 60. The hirer must use the furniture for a proper purpose. If it is applied to a purpose inconsistent with the terms of the contract, or if it is sold by the hirer, the owner is entitled to maintain an action for its value. These general rules may be regarded as prevailing both in England and Scotland. In case of willful injury done to furniture by a tenant within the metropolitan police district, it is provided by 2 and 3 Vict. c. 71, s. 38, that the police magistrate may award compensation to the amount of £15. In England as well as Scotland, the use of furniture for life is often made the subject of a bequest; and in this case, allowance will be made for ordinary wear and tear in the use of the furniture.

Lien on Furniture for Rent.—As a general rule, all furniture found on the premises, whether the property of the tenant or of a third party, may be distrained for rent, on the principle that the landlord has a lien over it in respect of the place in which it is found, and not in respect of the person to whom it belongs. To this rule there are some exceptions in favor of trade, as of tools in actual use, etc. In Scotland, the landlord has a similar right over the furniture in a house, so that hired furniture may be seized; but furniture lent without payment of rent does not fall under this hypothec (q.v.). Even where furniture has been sold, the landlord has a claim over it while it remains on the premises.

FURRUCKABAD, the district of which the city of the same name is the capital, in the North-west Provinces, stretches in n. lat. between 26° 46′ and 27° 43′, and in e. long. between 78° 57′ and 80° 2′. With a pop. of (1871) 918,784, it contains only 1702 sq.m., scarcely one twelfth of the area being beyond the limits of the Doab. The commercial crops are principally cotton, tobacco, and indigo.

FURRUCKABAD′, (Happy Residence), a city of the Doab (q.v.), stands near the right bank of the Ganges, in lat. 27° 24′ n., and long. 79° 40′ east. It is a handsome, cleanly, and healthy place, 570 ft. above the level of the sea, with a considerable trade, and a pop. of (1871) 79,204. Independently of its position on the grand artery of the country, F. is within 20 m. of the great route between Calcutta and Delhi. Here lord Lake defeated the troops of Holkar in 1805.

FURS, in heraldry. Shields being often covered with the skins of wild animals, on which the fur was left, there came to be certain kinds of fur which were used in coat-armor, as well as in trimming and lining the robes of knights and nobles, and the mantles which were represented as surrounding their shields. The principal heraldic F. are—1. Ermine of which the field is white, and the spots black: 2. Ermines of which the field is black, and the spots white; 3. Erminois which has the field gold, with black spots; 4. Vair, which consisted of pieces of the shape of little glass pots (Fr. *verres*, of which the word is a corrupt spelling). It is said that the furriers used such glasses to whiten furs in, and because they were commonly of an azure (blue) color, the fur in question came to be blazoned *argent* and *azure;* whilst counter-vair, in which the cups are represented as placed base against base, in place of edge to base, as in vair was *or* and *azure*. 5. Potent and counter-potent, which are supposed to resemble the heads of crutches, placed differently, but having the same tinctures—viz., azure and argent.

FUR-SEAL, a species of the family *otariidæ*, comprising eared seals, which have a thick under-coat of fine fur. They are eagerly hunted for their valuable skins. The Alaskan species is the *callorhinus ursinus*. See SEAL, *ante*.

FÜRST, JULIUS, a distinguished orientalist of Jewish parentage, was b. May 12, 1805, at Zerkowa, in the grand-duchy of Posen, Prussia, where his father was lecturer on circumcision in the synagogue. F. was educated for the rabbinical profession, and displayed at a very early age a most remarkable power of acquiring knowledge. He studied at Berlin, where the German philosophy made sad havoc of his previous convictions. The conflict in his mind between science and rabbinical lore ended, in 1829, in the defeat of the latter, and F. immediately proceeded to Breslau, where he continued his oriental, theological, and antiquarian studies, which were completed at Halle in 1831, under Gesenius, Wegscheider, and Tholuck. In 1833, he went to Leipsic, where he became professor in the university in 1864. Among his numerous and valuable writings may be mentioned *Lehrgebäude der Aramäischen Idiome* (System of Aramaic Idioms, Leip. 1835), a work which brought the Semitic languages within the sphere of comparative grammar, then in its infancy, and which, besides, sought to establish a system of analytico-historic investigation in regard to these languages themselves; *Perlenschnüre Aramäischer Gnomen und Lieder* (Pearl-strings of Aramaic Gnomes and Songs, Leip. 1836), with elucidations and glossary; *Concordantiæ Librorum Sacrorum Veteris Testamenti Hebraicæ et Chaldaicæ* (Concordances of the Sacred Books of the Old Testament in Hebrew and Chaldee, Leip. 1837–40), a work of indefatigable industry and careful research, which has obtained for its author a great reputation both in Germany and other countries; *Ari Nohem* (Leip. 1840), a polemical treatise on the genuineness of the Sohar and the worth of the Cabbala; *Die Sprüche der Väter* (The Sayings of the Fathers, Leip. 1839); *Die Israelitische Bibel* (The Hebrew Bible, Berlin, 1838), translated into German from the original, by himself, in conjunction with other scholars; *Der Orient; Berichte, Studien und Kritiken für Jüdische Geschichte und Literatur* (The East; Notices, Studies, and Criticisms in connection with Jewish History and Literature, Leip. 1840); *Die Jüdischen Religionsphilosophen des Mittelalters* (The Jewish Religious Philosophers of the Middle Ages, Leip. 1845); *Geschichte der Juden in Asien* (History of the Jews in Asia, Leip. 1849); *Bibliotheca Judaica* (1849–53); *Hebräisches und Chaldäisches Handwörterbuch* (Hebrew and Chaldee Manual, Leip. 1851–54); and an edition of Winer's *Chaldee Reading-Book* (1864). He died in 1873.

FÜRSTENBERG, the name of two noble houses of Germany. The most important is in possession of a mediatized principality in the district of the Black Forest and the Upper Danube, which comprises the countship of Heillgenberg, the landgravates of Stühlingen and Baar, and the lordships of Jungnau, Trochelfingen, Hausen, and Mösskirch or Messkirch. The territory is discontinuous, partly in Baden, partly in Würtemberg, and partly in the Prussian province of Sigmaringen. The head of the family is an hereditary member of the first chamber of Baden, and of the chamber of peers in Würtemberg and in Prussia. The relations of the principality with Baden are defined by the treaty of May, 1852, and its relations with Würtemberg by the royal declaration of 1839. The Stammort or ancestral seat of the family is Fürstenberg, in the Black Forest, about 18 m. n. of Schaffhausen, but the principal residence of the present representative of the main line is at Donaueschingen. The Fürstenbergs are descended from the counts Urachs, in the valley of the Ems, to the e. of Tübingen,—Henry I., the youngest son of Egon VI. of Urach, ranking as the founder of the family.

The second Fürstenberg family has its possessions in Westphalia and the country of the Rhine, and takes its name from the castle of Fürstenberg on the Ruhr, which is said to have been built by count Dietrich or Theodoric of Oldenberg in the 11th century. The two most remarkable men whom it has produced are Francis Frederick William, and Francis Egon. The former (1729–1811) became ultimately minister of the prince-bishop of Münster, and effected a great number of important reforms in the administration of the country; and the latter (1797–1859) was an enthusiastic patron of art, zealously advocating the completion of the Cologne cathedral, and erecting the beautiful church of Apollinaris, near Remagen, on the Rhine.

FÜRSTENWALDE, a small walled t. of Prussia, in the province of Brandenburg, on the right bank of the Spree, 30 m. e.s.e. of Berlin. It has a brick church of the 14th c., the *Marienkirch*, which contains a fine Gothic *Sacramentshäuschen* (or pyx for keeping the host), built of sandstone, and dating from 1510. F. manufactures linens and woolens, and carries on some trade by river. Pop. '75, 9,688.

FÜRTH, a flourishing manufacturing t. of Bavaria, in Middle Franconia, is situated at the confluence of the Rednitz and the Pegnitz, about 5 m. n.w. of Nürnberg, with which it is connected by a railway, laid out in 1835, and the first that was completed in Germany. It has numerous churches, synagogues, a town-hall, theater, etc. It is the most industrious and most prosperous manufacturing town of Bavaria; its mirrors, chandeliers, snuff-boxes, lead-pencils, its brass and wood wares, and its articles of dress, are famous. The making of metallic leaf, and the manufacture of articles in bronze, are most important branches of industry. F. also produces pinchbeck rings, watch-keys, brass nails, spectacles and optical instruments, in great abundance. An annual fair, lasting fourteen days, takes place at Michaelmas. Pop. '75, 27,369, of whom 4,000 are Jews, and the rest Protestants. F. first appears in history about the beginning of the 10th c., when it belonged to the archbishops of Bamberg. Subsequently it acknowledged the authority of the Burgrafs of Nuremberg. In 1634, during the thirty years' war, the Austrian Croats burned it to the ground. In 1680, a great fire almost laid it in ashes again. It first began to attain importance as a seat of manufactures in the latter half of the last century.

FURY AND HECLA STRAIT, lying in lat. 70° n., and long. from 82° to 86° w., separates Melville peninsula on the s. from Cockburn island on the n., and connects Fox's channel on the e. with the gulf of Boothia on the west. It is of no value whatever as a means of communication, nor is ever likely to be so, its western entrance having been ascertained by capt. Parry, who discovered it, on his second voyage, to be impenetrably closed from shore to shore by the accumulated ices of many years. It is traversed from w. to e. by a strong current, which passes down Fox's channel into Hudson's strait.

FURZE, *Ulex*, a genus of plants of the natural order *leguminosæ*, sub-order *papilionaceæ*, distinguished by a two-leaved calyx with a small scale or bractea on each side at the base, stamens all united by their filaments, and a turgid pod scarcely longer than the calyx. The COMMON F. (*U. Europæus*), also called WHIN and GORSE, is a shrub about 2 or 3 ft. high, extremely branched; the branches green, striated, and terminating in spines; the leaves few and lanceolate; the flowers numerous, solitary, and yellow. It is common in many of the southern parts of Europe and in Britain, although it does not reach any considerable elevation on the British mountains, and often suffers from the frost of severe winters; whereas in mild seasons its flowers may be seen all winter, so that there is an old proverb, "Love is out of season when the furze is out of blossom." It is scarcely known in any of the northern parts of Europe; and Linnæus is said to have burst into exclamations of grateful rapture when he first saw a common covered with F. bushes glowing in the profusion of their rich golden flowers. F. is sometimes planted for hedges, but is not well suited for the purpose, occupying a great breadth of ground, and not readily acquiring sufficient strength; besides, it does not, when cut, tend to acquire a denser habit. It is useful as affording winter food for sheep, and on this account is burned down to the ground by sheep-farmers when its stems become too high and woody, so that a supply of green succulent shoots may be secured. In some parts of Wales, F., chopped and bruised, forms the principal part of the winter fodder of horses. In some places, it is sown to yield green food for sheep or other animals, but is preferable to other green crops only on dry sandy soils, where they could not be advantageously cultivated. It is most extensively cultivated in Flanders. It is chopped and bruised by means of a mallet, one end of which is armed with knife-blades; or by means of a simple machine, called a gorse-mill.—A double-flowering variety is common in gardens. A very beautiful variety, called IRISH F., because originally found in Ireland (*U. strictus* of some botanists), is remarkable for its dense, compact, and erect branches. A dwarf kind of F. (*U. nanus*) occurs in some places, and is perhaps also a mere variety; if so, there is only one species known.

In fox-hunting countries, F. is encouraged on account of the excellent *cover* it affords. It is also a favorite cover for rabbits.

FU-SAN, a port in Corea, 35° 6′ n., 129° 1′ e., in the province of Kien-sang. For many centuries this place has been a Japanese port (or *kai*, whence also Fusankai). It

is situated on a bay of the same name, containing an island called Tetsuye, on which many horses are reared. One league from Fu-san is the castle town of Sorio, and three leagues further is the large city of Torai (Corean, Tong Nai). During the year ending July, 1878, 24 steamers and 462 junks arrived at Fu-san, importing into Corea foreign goods amounting to $341,818, and Japanese goods worth $58,815; the Corean exports amounting to $450,039.

FUSA'RO, Lake of, a small lake of s. Italy, in the province of Naples, 11 m. w. from Naples, on the peninsula of Baiæ. It is not far from the site of the ancient Cumæ, of which it is supposed to have been the port. Numerous remains of massive buildings, villas, and tombs are still to be seen in the neighborhood. At the southern extremity of the lake is a canal of Roman construction, communicating with the sea, now known as the *Foce del Fusaro*. The water of the lake is brackish, more salt than fresh. The lake is famous for its oysters, which have been cultivated here (see OYSTER) since the times of the ancient Romans. They are larger and of finer flavor than those of the bay of Naples. The lake is supposed to be the crater of an extinct volcano; and, in 1838, great quantities of noxious gases were emitted, by which the oysters of the lake were killed. The lake of F. received from the ancients the name of *Acherusia Palus*, probably at first bestowed upon it by the Greeks of Cumæ in consequence of its proximity to Avernus, and its crater-like character. In the later times of the Roman empire, however, its banks were adorned with the villas of wealthy Romans.

FUSE, or FUZE (*ante*), for firing shells, torpedoes, blasts, etc. A time F. is regulated to burn for a given time and then communicate fire to the exploding charge. Another time F. is known as the Borneman, and is regulated to a quarter of a second. A percussion F. is ready for action on discharge, and takes effect after striking any solid object. Care is necessary in making them so that they may not be likely to explode in handling or in ordinary transportation. The form used in the U.S. navy consists of a metal fuse stock inclosing a movable core-piece or plunger of steel bearing a musket-cap. When the shell strikes, the loose-fitting plunger continuing its motion explodes the cap and fires the charge. There are three or four kinds of percussion fuses. The concussion F. is put in action by the discharge, but the action is restrained until striking the object. Such fuses are made of high explosive fulminates, and are very dangerous to handle. For mining, electric fuses are used, called also exploders. They are of two classes: those in which the heat is obtained by the passage of the electric spark over a break in the circuit; and those in which the heat is obtained by the passage of the current over a conductor of great resistance. The first are tension fuses, and may be used with any static electric machine. There should be a very small break in the circuit, not greater than the spark can be made easily to pass over, and between the points of the break should be some substance that will be ignited by the passage of the spark. The second class embrace those in which, by the passage of the current, a portion of the circuit having a great resistance becomes sufficiently heated to ignite some explosive or inflammable substance in contact with it. Such fuses are used with the voltaic battery and the various dynamo-electric machines.

FUSE, FUSEE, a tube of wood or metal, perforated down the side with a vertical row of holes, and used for firing shells. The tube is filled with a composition of niter, sulphur, and gunpowder, which will burn gradually. The distance between each hole representing a second, the range and time of flight are computed, and that hole is left open which will communicate the fire in the fuse to the loaded shell at the moment the latter touches the ground after being discharged. Of course, when combustion reaches this aperture, the shell is burst by the explosion of the contained gunpowder, and scattered around in numerous fragments. Fuses constructed on a similar principle are used in exploding military mines (q.v.).

FUSEE', a spirally grooved cone in a watch or chronometer, with which the chain may be wound up on the pyramidal cone. This chain is attached to the box containing the spring, and the box rotates by the force of the uncoiling spring. The object of the peculiar form of the F. is, as the force of the spring is weakened by more and more uncoiling, to give a longer leverage at the other end of the chain (on the F.), and so to counteract the loss of power in the spring, thereby maintaining as nearly as possible a uniform rate of driving force.

FUSEL'I, HENRY, the second son of John Caspar Fuseli, or Fuessli, a portrait-painter, and author of *Lives of the Swiss Painters*, was b. at Zurich in 1742. He studied in his native town and at Berlin, traveled with Lavater in 1761, and then went to England, where, by Reynolds's advice, he devoted himself to art. In pursuance of this object, he proceeded to Italy in 1770, where he remained for eight years, studying in particular the works of Michael Angelo, and in 1778 returned to England. In 1790, he was elected a member of the royal academy, where, nine years later, he became professor of painting. He died at Putney hill, near London, April 16, 1825, and was buried beside his friend, sir Joshua Reynolds, in St. Paul's. His most remarkable works are "The Ghost of Dion," from Plutarch; "Lady Macbeth;" "Hercules and the Horses of Diomedes;" and his "Milton's Gallery," comprising 47 designs from *Paradise Lost*. F.'s imagination was bold, but coarse; he had more genius than art; and his execution was

often spasmodic in the extreme. His art-criticism, however, strange to say, ranks among the best in the language. His literary works, with a narrative of his life, were published by Knowles (3 vols., London, 1831).

FUSEL or FOUSEL **OIL**, known also as POTATO SPIRIT, is a frequent impurity in spirits distilled from fermented potatoes, barley, rye, etc., to which it communicates a peculiar and offensive odor and taste, and an unwholesome property. Being less volatile than either alcohol or water, it accumulates in the last portions of the distilled liquor. According to Liebig, it is principally formed in the fermentation of alkaline or neutral liquids, while it never occurs in acidulous fermenting fluids which contain tartaric, racemic, or citric acid. It mainly consists of a substance to which chemists have given the name of amylic alcohol, whose composition is represented by the formula $HO,C_{10}H_{11}O$. It is a colorless limpid fluid, which has a persistent and oppressive odor and a burning taste. It is only sparingly soluble in water, but may be mixed with alcohol, ether, and the essential oils in all proportions. Any spirit which produces a milky appearance, when mixed with four or five times its volume of water, may be suspected to contain it.

Fusel oil is principally sold in this country for the purpose of yielding pear essence for the so-called jargonelle-drops; it has likewise been patented as a solvent for quinine; and, according to Liebig, it is sometimes employed in lighting distillery buildings.

FUSIBILITY. With few exceptions, all solids which can bear a high temperature without undergoing chemical change, may be melted. Many substances which are popularly regarded as infusible—as, for example, platinum and flint—readily fuse before the oxyhydrogen blow-pipe, or between the poles of a powerful galvanic battery; even carbon has been partially fused by the last-named means. There are many substances which cannot be melted because they are decomposed by the action of heat. Thus, wood and many other organic compounds are decomposed into certain gases, which escape, and into carbon and fixed salts, which are left. Similarly, carbonate of lime (chalk) is decomposed into carbonic-acid gas and lime at a temperature below its fusing-point. If, however, we prevent the gas from escaping by confining the carbonate of lime in a hermetically closed gun-barrel, it can be melted at a high furnace-heat.

A table of "The Order of Fusibility of the Metals" is given by Miller in his *Elements of Chemistry*, 2d edition, vol. ii. p. 294.

FUSIBLE CALCULUS, a common form of stone, or urinary calculus. In the fusible form, the secretion is considerable, and is brittle, soft, smooth, and white. It contains ammonia-magnesian phosphate, calcium phosphate, and animal matter, and fuses readily before the blow-pipe.

FUSIBLE METAL. Fusible metal is composed of 2 parts of bismuth, 1 of lead, and 1 of tin. It fuses at 201° F., becoming pasty before it completely melts. It expands in a very anomalous manner; its bulk increases regularly from 32° to 95°; it then contracts gradually to 131°; it then expands rapidly till it reaches 176°, and from that point till it melts, its expansion is uniform. The faculty of expanding as it cools, while still in a comparatively soft state, renders the alloy very serviceable to the die-sinker, who employs it to test the accuracy of his die, every line being faithfully produced in the cast made of the alloy. The proportions of the three metals are sometimes varied, and another formula is given in the table in FUSING AND FREEZING POINTS.

FUSIL (Fr. *fusee*, a spindle) is represented heraldically as longer and more acute than a lozenge (q.v.).

FUSILIERS were formerly soldiers armed with a lighter fusil or musket than the rest of the army; but at present all regiments of foot carry the improved rifle. Fusilier is therefore simply a historical title borne by a few regiments—viz., the Scots fusilier guards, the 5th Northumberland, 7th royal, 21st North British, 23d Welsh, 87th Irish, 101st and 104th Bengal, 102 Madras, and 103d Bombay fusiliers.

FUSING AND FREEZING POINTS are terms applied to the temperature at which solids assume the liquid form, and liquids become solid. The following table gives some of the best determinations of the fusing point:

Mercury	−39°	Alloy (1Sn,2Bi)	286°
Oil of vitriol	−30°	" (3Sn,2Pb)	333°
Bromine	9.°5	Tin	451°
Oil of turpentine	14°	Bismuth	512°
Ice	32°	Nitrate of soda	591°
Lard	91°	Lead	620°
Phosphorus	111.°5	Nitrate of potash	642°
Potassium	136°	Zinc	773°
Yellow wax	143.°6	Antimony (about)	900°
Stearic acid	158°	Silver	1773°
Sodium	207.°7	Copper	1996°
Fusible metal (5Pb,3Sn,8Bi)	212°	Gold	2016°
Iodine	236.°4	Cast iron	2786°
Sulphur	239°	Wrought iron, higher than	3280°

We see from this table that alloys may have a fusing-point far below that of any of the metals which enter into their composition. Similarly, mixtures of various silicates fuse at a temperature far below that which is required to melt any one of them, and the same remark applies to mixtures of various chlorides, carbonates, etc.

Most solids, when heated to their fusing-point, change at once into perfect liquids; but some—as, for example, platinum, iron, glass, phosphoric acid, the resins, and many others—pass through an intermediate pasty condition before they attain perfect fluidity, and, in these cases, it is difficult, if not impossible, to determine the exact fusing-point. This intermediate condition is termed *vitreous fusion*, because it is a characteristic property of glass. It is in this intermediate state that glass is worked, and iron and platinum forged.

As a general rule, the freezing-point is the same as the fusing-point—that is to say, if a substance in the liquid form be cooled below the fusing-point, it again becomes solid; but there are cases in which we can cool a liquid several degrees below its fusing-point; thus, by keeping water perfectly still, we can cool it to 5°, or even to 1°.4 before it freezes. If, however, we drop a solid body into water in this condition, or if we shake the vessel containing it, congealation begins at once, and the temperature rises to 32°. This phenomenon is exhibited to a still greater degree in viscid fluids, like the oils. It is well known that the freezing-point of water is depressed by the presence of salts. Thus, sea-water freezes at about 26°.6, and a saturated solution of common salt must be cooled as low as 4° before freezing. Despretz has given the freezing-points of various saline solutions at different degrees of concentration in the fourth volume of the *Comptes Rendus*, p. 435.

FUSIYAMA. See Fuji-Yama.

FUST, Johann (Faust, *ante*), d. 1466; generally considered one of the inventors of modern printing, Gutenberg being another. (See Gutenberg, *ante*.) Fust was a rich and respectable member of a burgher family in Mainz, but not related to the patrician family of Fuss. The name was written Fust until, in 1506, Johann Schöffer, in dedicating the German translation of Livy, called his grandfather Faust. The family accepted the spelling and claimed Johann as one of their most distinguished ancestors. Fust appears to have been a money-lender, more renowned for prudence than for disinterestedness. His connection with Gutenberg, who is generally regarded as the real inventor of printing, has been variously represented, and during the present century F. has been pictured as a greedy speculator who took advantage of Gutenberg's necessity to rob him of the fruits of his invention. The first evidence of Gutenberg's obligations to F. would fix Aug. 22, 1449, as the day on which he borrowed 800 gold florins; but the Mazarin Bible (as it is now called) was completed years earlier. In the agreement mentioned, F. was to give Gutenberg 300 florins a year for expenses, wages, house-rent, parchment, paper, ink, etc. They were to divide the profits equally, and, if they wished to separate, Gutenberg was to return the 800 florins, and the materials were no longer to be security. F., as partner in the firm and holder of the mortgage, was to have half the profits. Gutenberg's great work was the Bible of Forty-two Lines, so called because there were 42 lines of print on each page, but now known as the Mazarin Bible, from the fact that a copy was found in the great cardinal's library. (There is a copy of this Bible in the Lenox library, New York city.) This work, a folio of 1282 pages, was finished in 1455. Various other works were issued by their press, when F., quite unexpectedly, it seems, and before the profits of the undertaking could be realized, brought a suit against Gutenberg to recover the money he had lent, claiming 2,026 florins for principal and interest. He had made a second loan in 1452 of 800 florins, but had not paid the 300 florins a year. The suit was decided in Fust's favor, Nov. 6, 1455. He took possession of the printing materials and went on with the work, having the aid of Peter Schöffer, to whom he gave his only daughter (Dyna) in marriage. F. is said to have gone to Paris in 1466, and to have died there of the plague. Until lately he has been confounded with the mythical magician, known as Dr. Johann Faust, no doubt a real personage, in spite of the many mystical traditions associated with his name. Even in the printing-houses of the present day these superstitions survive in the common title of "printer's devil," conferred upon the youngest apprentice—for Dr. Faust, the great magician, was credited with the invention of printing, and the art was popularly supposed to have been taught him by the devil; at least, that was the interpretation of the priests and other churchmen of the time. This wide-spread story of magic is worth tracing. Trithemius speaks in 1507 of magister Georgius Sabellicus, who called himself Faustus Junior. Conradus Mctianus Rufus (Conrad Mudt) in 1513, calls him "*quidam chiromanticus Georgius Faustus.*" But Melanchthon and the author of the oldest popular history of Faust, call the magician John, which name has been adopted in the popular books and generally accepted. This change of name, which has been variously explained, assisted in confusing the traditional remembrance of the printer, and led to its being worked into the Faust saga, perhaps the more readily as in his colophons Fust said that his books were not made with pen or pencil, "*sed arte quædam perpulchra.*" The confusion has been much assisted by the history of Fust's supposed prosecution for magic, which, widely credited, and frequently repeated as an authentic anecdote, seems to have been first mentioned by

Johann Walchius in 1610. He relates on the authority of Hendrik van Schore, or Schorus, a Flemish author, then an old man and provost of Surburg, that when Fust sold his Bibles in Paris, the purchasers, surprised to find all the copies agree exactly in every letter, complained of deception, and bringing back their books demanded their money, and pursued him even into Mainz, so that to escape he removed to Strasburg. John Conrad Durr, professor of theology at Altdorf, wrote an "*Epistola de Johanne Fausto*," dated July 18, 1676. Durr (after relating from Emmanuel van Meteren the tale of Koster's types being stolen on Christmas eve by John Fust, his workman, who fled to Amsterdam, then to Cologne, and lastly to Mainz), says that, on showing his books, F. was suspected of magic, as he could print in one day as much as several men could write in a year, and as the monks and nuns, who had long made great profits by copying, found their kitchens grow cold, and their bright fires extinguished, F. incurred their hatred and calumny, and was transformed into a magician; and this opinion was confirmed by his printing the *Doctrinale Alexandri*, a most popular mediæval Latin grammar, which gave rise to the story that Faust had caused Alexander the great to appear to Charles V. Lacaille repeats the account, with some additions. The whole story, as Bernard says, is so improbable as scarcely to deserve a serious refutation. There is no proof that the monks were hostile to printing, or that it interfered with the profits of the copyists. On the contrary, many books were printed by the monks; the early printers often set up their presses in monasteries, and Gutenberg, Fust, and Schöffer were on friendly terms with many conventual houses. Durr himself quotes from the *Chronicle of Aventinus* a statement that, if printing had not been discovered, the old books would have been lost, as the inmates of the monasteries would no longer write. Printing did the mechanical work, and multiplied the material for caligraphy and illumination, and therefore did not at first interfere with the profits of the scribes, or excite their hostility. The learned men who bought books in 1463 cannot have been ignorant of the invention of printing, which the colophon of the Bible of 1462 expressly mentions. No trace of a suit against F. has been found in the registers of the parliament of Paris. Shortly before his death, F. was known in Paris to Louis Lavernade, a magistrate of the highest rank, who could have had no intercourse with a man accused of magic. The confusion is especially seen in the German puppet plays, even now placing Dr. Faust in Mainz, while the popular history makes him dwell in Wittenberg, the birthplace of Protestantism, where Marlowe's *Tragical History of Dr. Faustus*, founded on the prose history, places him. Many writers have accepted Durr's error; thus Chasles calls Fust "*magician a barbe blanche*," and Victor Hugo's introduction to Marlowe's play is based on this error, which, says Heine, "is widely spread among the people. They identify the two Fausts because they perceived indistinctly that the mode of thought represented by the magicians found its most formidable means of diffusion in the discovery of printing. This mode, however, is thought itself as opposed to the blind *credo* of the middle ages." [Mainly from *Encyc. Brit.*, 9th ed.]

FUSTIAN, a cotton fabric having a pile like velvet, but shorter, and which is manufactured in nearly the same manner as velvet—viz., by leaving loops standing upon the face of the fabric, and then cutting them through so as to form upright threads, which are afterwards smoothed by shearing, singeing, and brushing. See VELVET.

FUSTIC, a name given to two kinds of dye-wood used for producing a yellow color, and with chemical additions, other colors, such as brown, olive, and green. The name seems to be derived from the French *fustet*, the name of the Venice sumach (*rhus cotinus*, see SUMACH), a shrub found in the s. of Europe; and to have been transferred to a very different plant, the *maclura tinctoria* of Don, or *morus tinctoria*, a tree of the natural order *moraceæ*, a native of the West Indies, Mexico, Brazil, Colombia, etc. The F. is a large and handsome tree, the wood is of a greenish-yellow color, and is sometimes used in mosaic cabinet-work and turning, but chiefly in dyeing. About 10,000 tons are imported annually into Britain. The tree is particularly abundant in Campeachy. The wood contains a great quantity of coloring matter, which forms the most durable of vegetable yellow dyes; but as the color is rather dull, it is more used for producing other colors. The name OLD FUSTIC is sometimes given to it, and YOUNG FUSTIC to the wood of *rhus cotinus*. These terms began to be employed about the beginning of last century, from the mistaken notion that the one, in small pieces, was the wood of the young tree, and the other, in comparatively large logs, of the same tree in a more mature state.—The OSAGE ORANGE (q.v.) of North America (*maclura aurantiaca*) is nearly allied to old F., and its wood also affords a yellow dye.

OLD FUSTIC, or yellow wood, is employed for dyeing woolens yellow, and also to impart to them green and olive colors when mixed with indigo and salts of iron. It furnishes a yellow coloring matter, which may be obtained in crystals by evaporating its watery solution. This substance is termed moritannic acid, and its composition is represented by the formula $C_{26}H_{16}O_{20}$. The bichromates of potash and of lead have to a great degree superseded the use of OLD FUSTIC.

YOUNG FUSTIC is the wood of *rhus cotinus* or *Venetian sumach*. It contains a yellow coloring matter, to which the name *fusteric* has been given. It is generally used in combination with other dyes, in order to strike some particular tint.

FUSUS (Lat. a spindle), a genus of gasteropodous mollusks nearly allied to *murex* (q.v.), having a spindle-shaped shell, with a very elevated spire, the first whorl often much dilated, and a straight elongated canal. The whorls are not crossed by varices, as in *murex*. The species were formerly, however, included in that genus. About 100 existing species have been described, and more than three times that number of fossil ones. The existing species are distributed over the whole world, living generally on muddy and sandy sea-bottoms at no great depths. *F. antiquus* is known in the s. of England as the RED WHELK, and in Scotland as the ROARING BUCKIE, from the continuous sound—as of waves breaking on the shore—heard when the empty shell is applied to the ear. In the cottages of Zetland, the shell, generally about 6 in. long, is used for a lamp, being suspended horizontally by a cord, its cavity containing the oil, and the wick passing through the canal. This mollusk is often dredged up with oysters. It is eaten by the poor, but is more generally used as bait for cod, skates, etc.

This genus makes its first appearance in the oolite, in which 10 species have been noticed. The numbers increase to 35 in the cretaceous rocks, to 100 in the eocene, and to 150 in the miocene and pliocene.

FUTAK', a t. of lower Hungary, in the co. of the Lower Bacs, is situated on the left bank of the Danube, in lat. 45° 15' n., and long. 19° 42' west. It has a beautiful castle and garden, and the inhabitants grow vegetables and tobacco extensively. F. has a great trade in corn, and has a fair in Nov., frequented by merchants from Turkey, Greece, and Armenia. Pop. '69, 4,642.

FUTEHGUNGE (in English, *Victory Market*) is the name of two places in Rohilcund, the scenes respectively, as the name implies, of two battles gained by the British over the Rohillas.—1. *Eastern* F., a t. of the district of Bareilly, is situated near the right bank of the Bhagal, in lat. 28° 4' n., and long. 79° 42' east. The action from which this spot is designated was fought in 1774, giving to the nawâb of Oude, then an ally of the English East India company, a large part of Rohilcund; and it was, in fact, to commemorate that event, that eastern F. was built by that prince.—2. *Western* F., a t. also of the district of Bareilly, is situated in lat. 28° 28' n., and long. 79° 24' east. The conflict that distinguished this locality occurred in 1796. The only eminence in the neighborhood, the most hotly contested point in the struggle, bears twofold testimony to the story, in the memorials of those who fell—a plain and simple monument of fourteen British officers, and a carved and minareted tomb of two Rohilla chieftains.

FUTTEHPUR, the district of which the t. of the succeeding article is the capital, lies wholly within the Doab, and occupies its entire breadth from Jumna to Ganges. It extends immediately to the w. of the district of Allahabad, in lat. from 25° 25' to 26° 13' n., and in long. from 80° 12' to 81° 23' e., containing 1583 sq.m., and (1871) 663,815 inhabitants. It yields large quantities of cotton, and by means of its bordering rivers, and a branch of the Ganges canal, it possesses considerable facilities for inland navigation.

FUTTEHPUR, a t. of the Doab, North-west Provinces, on the great trunk-road between Calcutta and Delhi, stands in lat. 25° 57' n., and long. 80° 54' e., 70 m. n.w. of Allahabad, and 50 m. to the s.e. of Cawnpore. It is a thriving place, with (1871) 20,478 inhabitants. Besides the buildings belonging to the civil establishment of the district of its own name, it contains a small but very elegant mosque.

FUTTUHA, or FUTWA, a t. of (1871) 11,295 inhabitants, in the district of Patna, and presidency of Bengal, stands at the confluence of the Punpun and the Ganges, in lat. 25° 30' n., and long. 85° 22' east. As the Ganges is here deemed peculiarly sacred, F. is, at certain seasons of the year, the resort of vast numbers of pilgrims.

FUTTYGURH, the military cantonment of Furruckabad, stands about 3 m. to the e. of that city, on the opposite or left bank of the Ganges, being in lat. 27° 22' n., and long. 79° 41' east. Its name became peculiarly famous, or rather infamous, in the mutiny of 1857, less, however, for the outbreak that occurred on the spot, than for the unparalleled sufferings of the hapless fugitives—men, women, and children. Pop. '71, 10,335.

FUTTYPUR', a t. in the district of Saugur, and chief-commissionership of the Central Provinces, stands on the Unjon, a tributary of the Nerbudda, about 20 m. from the point of junction, being in lat. 22° 38' n., and long. 78° 38' east. It is a place of some importance, as being the residence of three Gond rajahs.

FUTURE DEBT is a debt wherein the obligation to pay and the time for payment is fixed and certain, but the day for performance has not arrived. Of such a debt, it was said in the civil law *dies cedit etsi nondum venerit*; and it was distinguished from a contingent debt, i.e., a debt payable on the performance of a condition which was uncertain, in which it was said *dies nec cedit nec venit*. Thus, an obligation to pay six months hence is a future debt; an obligation to pay "if my ship returns from Spain," is contingent. In the event of the death or bankruptcy of a person having large commercial transactions, it is often of great importance that the right of the holders of such securities should be accurately fixed. In Rome, on the death or bankruptcy of a citizen, a creditor holding a claim for a F. D. was entitled to payment, deducting a percentage proportionate to the date at which his debt was payable; but a contingent creditor only received a security for payment in case his debt should become payable. This general

principle has been introduced into the legal systems of modern states. In Holland and in France, the rights of creditors having claims not immediately payable are based upon the rule of the civil law. In England, a F. D., in order to found a valid claim, must be in writing, but it may be constituted by bond, bill, or note or other security. By common law, such a claim could not be enforced until the actual time for payment has arrived; and formerly, in case of bankruptcy, a creditor on a debt of this kind was not allowed to insist in his claim. At the same time the bankrupt's discharge was held not to release him from a debt which had not been admitted to claim in the process; and hence debtors were sometimes incarcerated for years on debts which they were wholly unable to discharge. See IMPRISONMENT FOR DEBT. This state of things was productive of manifest injustice on both debtor and creditor; on the latter, by excluding him from insisting in his claim at a time when he might have obtained a partial payment; on the former by punishing him for his default when he was deprived of the means of making any return. The subject was frequently discussed in parliament before a remedy was applied. At last, by 6 Geo. IV. c. 16, s. 51, it was enacted that in cases of bankruptcy, where a debt was not immediately payable, the creditor should be entitled to prove his debt, and receive a dividend; deducting interest at 5 per cent for the period which was to elapse before the date when the debt was payable in due course. By s. 56, debts payable on a contingency might be valued, and a dividend paid on the estimated value. Similar provisions were inserted in the 12 and 13 Vict. c. 196, ss. 172 and 177. By the last bankruptcy act, 24 and 25 Vict. c. 134, s. 153, it is enacted that a person having a claim for unliquidated damages, which are of the nature of a F. D., may have his claim assessed by a jury either in the court of equity, or before a common-law judge, or, in case of agreement between the parties, by the court without a jury.

By the common law of Scotland, the rule of the civil law, as to the rights of creditors having a future claim, has always been recognized. In the event of bankruptcy, creditors in both future and contingent debts are allowed to rank, but the latter only to the extent of receiving a security until the condition is purified. But by 19 and 20 Vict. c. 79, s. 53, which is now the ruling statute as to bankruptcy in Scotland, contingent creditors may have their debts valued, and may vote in the sequestration (q.v.), and draw dividends proportionate to the valuation. It is also enacted, s. 14, that all creditors whose debts are not *contingent* may concur in the petition for bankruptcy. But the Scotch law affords to future debtors a further privilege, unknown to the system of the sister-country—viz., that of arrestment in security, whereby a creditor having a future claim is enabled, in case his debtor seem to be willfully diminishing his means of discharging his debt, to attach the goods of the debtor as a security for the payment of his debt. See ARRESTMENT.

FUTURE ESTATE, an estate of which possession is to commence at some future time. It includes remainders, reversions, and estates limited to commence in possession at a future day, without the intervention of a precedent estate to support them, which last are good in common law only in the case of a term of years. Such future estates are declared to be either vested, or contingent. They are vested when there is a person in being who would have an immediate right to the possession of the land upon the ceasing of the intermediate or precedent estate. They are contingent while the person to whom or the event upon which they are limited to take effect, remains uncertain.

FUTURE LIFE. See IMMORTALITY, *ante*.

FUX, JOHANN JOSEPH, 1661–1741; b. Styria; the composer of more than 400 works of various kinds and dimensions, but chiefly remembered as the author of a theoretical work on music. Of his youth and early training nothing is known. In 1696, he was the organist at one of the principal churches of Vienna, and in 1698 was appointed by the emperor Leopold I. as his "imperial court composer," with the considerable salary of $30 a month. At the court of Leopold and his successors Joseph I. and Charles VI., F. remained for the rest of his life. To his various court dignities, that of organist of St. Stephen's cathedral was added in 1704. As a proof of the high favor in which he was held by the art-loving Charles VI., it is related that at the coronation of that emperor as king of Bohemia in 1723, an opera, *La Constanza e la Fortezza*, especially composed by F. for the occasion, was given at Prague. The performance took place in an open-air theater, and the *mise-en-scene* is said to have been of great splendor. Fux at the time was suffering from gout, but in order to enable him to be present at the performance, the emperor had him carried in a litter all the way from Vienna, and a seat in the imperial box was reserved for the composer. The numerous operas which F. wrote show no surpassing genius. Of greater importance are his sacred compositions, psalms, motets, oratorios, and masses. Among the latter, the celebrated *Missa Canonica* is an amazing *tour de force* of learned musicianship, being written entirely in that most difficult contrapuntal devices—the canon. Owing to his qualities as a contrapuntist and musical scholar generally, his great theoretical work, the *Gradus ad Parnassum*, has preserved its importance to the present day. For a long time it remained by far the most thorough treatment of counterpoint and its various developments. It was translated into most European languages during the 18th c., and is still studied by musicians interested in the history of their art.

FYNE, LOCH, an arm of the sea running n. and n.e. from the sound of Bute, in the s. of Argyleshire, to beyond Inverary, in the n., and is bounded by the district of Cowal on the e., and by those of Argyle, Knapdale, and part of Cantire on the west. It is 43 m. long, 2 to 10 m. broad, and 40 to 70 fathoms deep. Its shores are deeply indented, and bordered by low, bare hills, which rise higher and are wooded near Inverary. On the w. side, it sends off a small branch leading to the Crinan canal. Loch F. is celebrated for its herrings.

FYROUZ' I. (also called ARSACES XXIV., king of Parthia), one of the Arsacide kings of Persia, who reigned 83–103. The name is often spelled Feroze or Firouze, and means "victorious."

FYROUZ' II., 458–484, King of Persia, of the Sassanide dynasty. He overthrew and put to death his younger brother Hormuz, and so came to the throne. He was warred upon by the White Huns, who finally defeated him, and slew him and 29 of his sons. Historians differ widely as to his character and ability.

FYROUZ' III., d. 679; the last Sassanide monarch. He was expelled from Persia by the new Mohammedan power, and took refuge with the emperor of China, who vainly endeavored to restore him to the Persian throne.

FY'ROUZE, or FEROZE, SHAH I., a Mohammedan king of Delhi, succeeding his brother in 1236 A.D., after having been governor of Lahore. He was deposed in the first year of his reign by his sister, the sultana Rezia.

FY'ROUZ SHAH III., 1269–1388; King of Delhi; successor of Mohammed III., in 1351. His reign was tranquil, and his country prosperous. He founded the city now called Ferozepoor, and commanded the construction of an important system of canals.

FYT, JOHANNES, 1609–61; b. Antwerp; the best painter of animals and game after Franz Snyder. F. entered the guild of St. Luke as a master, and from that time till his death, he produced a vast number of pictures in which the bold facility of Snyders is united to the powerful effects of Rembrandt, and harmonies of gorgeous tone are not less conspicuous than freedom of touch and a true semblance of nature. There never was such a master of technical processes as F. in the rendering of animal life in its most varied forms. He was not clever at figures, and he sometimes trusted for these to the co-operation of Cornelius Schut or Willeborts, whilst his architectural backgrounds were sometimes executed by Quellyn. "Silenus amongst Fruit and Flowers," in the Harrach collection at Vienna; "Diana and her Nymphs with the Produce of the Chase," in the Belvedere at Vienna, and "Dead Game and Fruit in front of a Triumphal Arch," belonging to baron Anselm von Rothschild at Vienna, are specimens of the co-operation respectively of Schut, Willeborts, and Quellyn. They are also Fyt's masterpieces. Great power is shown in the bear and boar hunts at Munich and Ravensworth castle. A splendid specimen is the "Page and the Parrot," near a table covered with game, guarded by a dog staring at a monkey, in the collection of sir Richard Wallace. It is curious that Antwerp should possess only two examples of Fyt. The Madrid museum contains 11, the Lichtenstein gallery at Vienna 8, the Berlin, Vienna, and Dresden museums 5 each, the Louvre 3, and the London national gallery 1. With the needle and the brush Fyt was equally clever. He etched 16 plates, and those representing dogs are of their kind unique.

FYZABAD, a rapidly decaying city of Oude, stands on the right bank of the Ghogra, here a navigable river, in lat. 26° 47' n., and long. 82° 10' east. Originally an appendage, as it were, of Ayodha or Oude, the ancient capital from which the country took its name, F. became, in 1730, itself the seat of government. But in 1775, immediately after the annexation of part of Rohilcund (see FUTEHGUNGE), it was supplanted by Lucknow, which lay about 90 m, to the w., in the direction of the newly acquired territory. Pop. '71, 37,804.

G.

G, **THE seventh letter in the Roman alphabet, and in the modern alphabets derived** from it. For the history of the character, see ALPHABET and letter C. The original and proper sound of G (corresponding to Gr. γ) is that heard in *gun, give, glad*. But the same natural process which turned the *k*-sound of *c* before *e* and *i* into that of *s* (see C), produced a similar change on G, so that before *e* and *i* it came to be pronounced by the Latins like *dzh*. The sibilation of the letter *g* before *i* followed by a vowel, had begun as early as the 4th c. A.D., as is evident from the misspelling in inscriptions; in the case of *c*, the change can be detected much earlier. From the Latin, the *dzh*-sound of *g* passed into the Romanic tongues, and also into English. As a general rule in English, in words derived from the classical and Romanic languages, *g* has the hissing sound before *e, i,* and *y;* it has its natural sound in all words before *a, o,* and *u;* and it retains it in Teutonic words even before *e* and *i*.

G, in its proper power, belongs to the order of gutturals, *k* or *c, g, ch, gh;* of the two

"bare" gutturals, *g* is the *flat* (or medial), and *k* the *sharp;* while *gh* and *ch* are the corresponding aspirates (q.v.).

The following are some of the interchanges between *g* and other letters: Lat. *ager*, Gr. *agros*, Eng. *acre*, Ger. *acker;* Gr. *triakonta*, Lat. *triginta;* Gr. *gonu*, Lat. *genu*, Eng. *knee;* Lat. (g) *nosco*, Gr. *gignosco*, Eng. *know;* Lat. *genus*, Eng. *kin;* Gr. *chen*, Ger. *gans*, Eng. *goose* and *gander;* Lat. *hesternus*, Ger. *gestern*, Eng. *yester* (day); Lat. *germanus*, Span. *hermano*. The convertibility of *g* and *y* is seen in the old English participles in *y*, as *yclad*, corresponding to Sax. and Ger. *ge-;* in Ger. *gelb*, Eng. *yellow;* Ger. *tag*, Eng. *day;* Ger. *mag*, Eng. *may; yate* for *gate; yard* for *garden*, Lat. *hortus*. In Italian, *gi* is substituted for *j*, as *Giulio* for *Julius;* and in French, which has no *w*, that letter is represented by *gu*, as *guerre*, *guarder*, for Eng. *war*, *ward*, or *guard*. G has been frequently dropped out, as Lat. *nosco* for *gnosco;* Eng. *enough*, compared with Ger. *genug; agone*, with *ge-gangen;* Lat. *magister*, Fr. *maistre* or *maître*, Eng. *master*. *May*, Lat. *Maius*, contracted from *Magius*, is from a root *mag*, or (Sans.) *mah*, to grow: so that May is just the season of growth.

G, in music, is the fifth sound of the natural diatonic scale of C, and the eighth sound of the chromatic scale. It stands in proportion to C as 2 to 3; is a perfect fifth above C, and the second harmonic arising from C as a fundamental note. In the solmization of Guido Aretinus, the note G was called sol, re, or ut, according as the hexachord began with C, F, or G. G major as a key has one sharp at its signature, viz., F sharp. G. minor has two flats at its signature, viz., B flat and E flat.

GAAL, JOZSEF, a Hungarian author, was b. at Nagy Karoly in 1811, studied at the college of Buda, and at the university of Pesth, and entered soon afterwards the administrative career, being attached to the Hungarian council of lieutenancy. G. began writing early, and proved equally successful when gossiping in the columns of Kossuth's famous *Pesti Hirlap*, and when engaged in translating a masterpiece of Cervantes, filling the periodicals with tales and novels, or furnishing original works for the National theater. The sketches of country life as it was, and as it still continues on the vast plains of Hungary, are nowhere to be found more vividly and more truly exhibited than in G.'s comedies and tales. The following are some of G.'s original compositions: *Szirmay Ilona*, a novel in 2 vols. (Pesth, 1836); *Peleskei Notarius* (The Notary of Peleske, Pesth, 1838), a comedy in four acts—might be called *the* Hungarian comedy *par excellence; Szvatopluk*, a tragedy in five acts. Tales: *Pusztai Kaland* (An Adventure on the Hungarian Prairies); *Tengeri Kalandaz Alfoeldœn* (Seafaring Adventures in Lower Hungary); *Hortobágyi éjszaka* (A Night on the Heath of Hortobágy). During the sojourn of the Hungarian diet at Debreczin (1849), G. was editor of a journal combating extreme radical views.

GABBRO, the name given by Italian geologists to a variety of greenstone composed of feldspar and diallage. It is equivalent to euphotide or diallage rock.

GABELENTZ, HANS CONON VON DER, a distinguished German philologist, was b. at Altenburg, Oct. 13, 1807, and educated at the universities of Leipsic and Göttingen. He then began to study the Finno-Tartaric languages, and published, in 1833, his *Eléments de la Grammaire Mandschoue*, a new grammar, in which the entire idiomatic character of that language was developed in concise rules. He had, moreover, a share in the establishment of a journal devoted to oriental science (*Zeitschrift für die Kunde des Morgenlandes*), and contributed to it some interesting papers on the Mongolian language. Along with J. Löbe, he also published a critical edition of the Gothic translation of the Bible by Ulfilas, with a Latin translation, and with a Gothic glossary and grammar appended (Leipsic, 1843–46). Besides a Syrjan grammar (*Grundzüge der Syrjänischen Grammatik*, Altenburg, 1841), he furnished contributions to periodicals on the Mordivinian and Samoyed languages. He also published some contributions to the science of language, the most important of which is his work upon *Die Melanesischen Sprachen* (2 vols., 1860 and 1873) The *Beiträge zur Sprachenkunde*, in three parts, appeared in 1852, and *Ueber das Passivum* in 1860. In 1864, he published the Mantchurian translation of the Chinese works, *Sc-schu*, *Schu-king*, and *Schi-king*, along with a glossary in German. G. knew upwards of 80 languages. He died in 1874.

GABERLUN'ZIE, a term in Scotland for a beggar, originally applied to licensed beggars or king's bedesmen, from the coarse woolen cloaks (*gaban*, cloak; and *lunzie*, linsey-woolsey) which they wore. They were also called "blue-gowns."

GABELLE, a French word, derived from the German *gabe*, gift or tribute, and originally used in a general way to designate every kind of indirect tax, but more especially the tax upon salt. This impost, first established in 1286, in the reign of Philippe IV., was meant to be only temporary, but was declared perpetual by Charles V. It varied in the different provinces. Those that were most heavily taxed were called *pays de grande gabelle*, and those that were least heavily taxed, *pays de petite gabelle*. It was unpopular from the very first, and the attempt to collect it occasioned frequent disturbances. It was finally suppressed in 1789. The name *gabelous* is, however, still given by the common people in France to tax-gatherers.

GA'BII, a very old and once important city of Latium, 12 m. e. of Rome. Long before the foundation of Rome, Gabii appears to have been one of the largest of the

Latin cities. It long maintained its independence; but after the time of Tarquin the proud, it appears in history as the ally or dependent of Rome. By gradual stages it fell into such a state of decay as to become a proverb of desolation. During the reign of Tiberius, its cold sulphurous springs attracted much attention, and it became a favorite fashionable resort. The emperor Hadrian patronized it, and supplied it with a town-house and an aqueduct. We hear little of G. after the 3d c., excepting in ecclesiastical history, where mention is frequently made of its bishops, up to the close of the 9th century. The principal relic of the ancient city is a ruined temple, probably dedicated to Juno, on a hill now crowned by the ruins of the mediæval fortress of Castiglione. Numerous and interesting statues and busts have been discovered. Quarries of an excellent building-stone, which was largely used by the Romans, existed in the neighborhood of Gabii. The Romans termed a peculiar method of girding the toga *cinctus Gabinus.* One end was thrown over the head, and the other fastened round the waist. This fashion was adopted by the founders of a new town, or by the consul when he "declared war in the name of the Roman people, or devoted himself to death for his country."

GABION (Ital. *gabbia*, related to Lat. *cavea*, hollow), a hollow cylinder of basket-work, employed in field or temporary fortification, and varying in size from a diameter of 20 in. to 6 ft., with a height of from 2 ft. 9 in. to 6 feet. In constructing it, stout straight stakes are placed upright in the ground in a circle of the required diameter, and are then wattled together with osiers or green twigs, as in the formation of baskets, The apparatus being raised, when completed, from the ground, the ends are fastened. and the G. is ready to be rolled to any place where it is desirable to form a breastwork against the enemy. Placed on end, and filled with earth, a single row of gabions is proof, except at the points of junction, against musketry fire, and by increasing the number of rows any degree of security can be obtained. The G. has the advantage of being highly portable, from its shape, while with its aid a parapet can be formed with far less earth, and therefore in less time, than in cases when allowance has to be made for the slopes on both sides, which are necessarily present in ordinary earthen walls. The *sap-roller* consists of two concentric gabions, one 4 ft., the other 2 ft. 8 in. in diameter, with the space between them wedged full of pickets of hard wood. In sapping (see MINES), these serve as substitutes for mantlets.

Stuffed gabions are gabions rammed full of broken branches and small wood; being light in weight, they are rolled before soldiers in the trenches, and afford some, though not a very efficient, protection against musketry fire.

Gabionnade is a line of gabions thrown up by troops as a defense, after being driven back from other more solid positions. In carrying a well-defended fortress, gabionnade after gabionnade has sometimes to be stormed before the besieged can be compelled to surrender.

GABLE, the triangular part of an exterior wall of a building between the top of the side-walls and the slopes of the roof. The whole wall of which the G. forms the top is called a gable-end; party-walls, or the walls which separate two contiguous houses, and which belong equally to both houses, are called in Scotland "mutual gables."

The G. is one of the most common and characteristic features of Gothic architecture. The end walls of classic buildings had *pediments* (q.v.), which followed the slope of the roofs, but these were always low in pitch. In mediæval architecture, gables of every angle are used with the utmost freedom, and when covered with the molded and crocketed copes of the richer periods of the style, give great variety and beauty of outline.

Gablets, or small gables, are used in great profusion in the more decorative parts of Gothic architecture, such as canopies, pinnacles, etc., where they are introduced in endless variety along with tracery, crockets, and other enrichments.

The towns of the middle ages had almost all the gables of the houses towards the streets, producing great diversity and picturesqueness of effect, as may still be seen in many towns which have been little modernized. The towns of Belgium and Germany especially still retain this mediæval arrangement. In the later Gothic and the renaissance periods, the simple outline of the G. became stepped and broken in the most fantastic manner. See CORBIE STEPS.

In Scottish law, a mutual G. or party-wall, though partly built on the adjoining property, belongs to the builder, and he can prevent his neighbor from availing himself of it for the support of his house, until he has paid half the expense of building it. For the law of England on this subject, see PARTY-WALL.

GABLENZ, LUDWIG KARL WILHELM VON, 1814–74; an Austrian general, b. Saxony, educated in Dresden military academy. He entered the Austrian service in 1833. After the conclusion of peace he traveled extensively, and visited the interior of Africa. In 1848, he served in Italy under Radetsky as staff-major, and was promoted to a colonelcy. In 1853, he was director of the bureau of statistics in Vienna. In 1859, he distinguished himself at Solferino. In 1864, he commanded the 6th corps in the war against the Danes in Holstein, and was present at Sadowa. At the conclusion of the war he retired from the army, and was chosen a life member of the Austrian upper house, on the liberal side. He re-entered the service in 1867, and assumed command in Croatia, and

in Hungary in 1869; finally retiring in 1871. Owing to the shock of financial losses, he put an end to his life by suicide.

GABOON' RIVER, THE, takes its rise in the Crystal mountains, a chain in western Africa, running almost directly e. and w., parallel to, and about 80 or 100 m. distant from, the coast. Flowing first in the direction of n. to s., it afterwards curves toward the n., and empties itself into the Atlantic in lat. about 0° 30' n., and long. 9° 10' east. Its mouth forms a bay of some 10 or 12 m. in length, with a breadth varying from 7 to 15 miles. The total length of the river is said to be about 120 miles. The G is deep and sluggish, the mass of its waters being tidal; 60 m. from its mouth the tide rises to a height of from 7 to 9 feet. The climate is unhealthy; but the profits of the trade in ivory, which is obtained abundantly in the territories through which the river flows, induced a French colony to settle and build a fort at the mouth of the river in 1842 or 1843. In the same year, an American mission, which still continues in active operation, was established at Baraka, about 8 m. up the river. The Gaboon country, besides ivory—of which, when the home demand is brisk, it yields about 80,000 lbs. annually—produces ibar-wood, a dye-wood from which a dark-red dye is obtained, ebony, and copal of inferior quality. The banks of the river, from its source to the ocean, are occupied by about a dozen tribes, chief of which is the Mpongeve, who hold its mouth. This division of territory renders the ivory much more costly than it otherwise would be, the first owners in the interior not being allowed to take it direct to the white trader at the coast, but compelled to transmit it through the hands of the intervening tribes, each of whom makes a profit.

GABRIEL (Heb. the man or mighty one of God) is, in the Jewish angelology, one of the seven archangels. He appears in the book of Daniel as the interpreter of the prophet's vision (chap. viii.), and announces the future appearance of the Messiah (chap. ix. 21–27). In the New Testament, he reveals to Zacharias the birth of John the Baptist (Luke i. 11), and to the virgin Mary the birth of Christ (Luke i. 26). According to the Rabbins, he is the angel of death for the people of Israel, whose souls are intrusted to his care. The Talmud describes him as the prince of fire, and as the spirit who presides over the thunder and the ripening of fruits. When Nebuchadnezzar besieged Jerusalem, G. is believed to have entered the temple, by command of Jehovah, before the Assyrian soldiery, and burned it, thereby frustrating their impious intentions. G. has also the reputation among the Rabbins of being a most distinguished linguist, having taught Joseph the 70 languages spoken at Babel, and being, in addition, the only angel who could speak Chaldee and Syriac. The Mohammedans hold G. in even greater reverence than the Jews, and regard him as the chief of the four most favored angels who form the council of God; he is called the spirit of truth, and is believed to have dictated the Koran to Mohammed.

GABRIEL, ST., ORDERS OF, in the Roman Catholic church, comprise two organizations: 1. A congregation of lay conventual brethren and non-conventual members at Bologna, devoted to the instruction of youth. 2. The brothers of St. Gabriel established in France in 1835, who also gave great attention to the spread of education in country places.

GABRIEL CHANNEL, in the Terra del Fuego islands, 54° 20' s., 70° 40' w., about 25 m. long, and from half a m. to 2 m. wide. In the center the banks rise abruptly to the height of 1500 feet. The channel is noted for the violent winds called by seamen "Williwaws."

GABRIEL'LI, CATARINA, 1730–96; b. Rome; the daughter of a cook in the employ of count Gabrielli, who, attracted by the child's fine voice, had her educated by Garcia. Her first appearance in opera took place in 1747, and she rapidly rose to eminence. In Parma, she became the mistress of Don Ferdinand, whose jealousy induced her to fly to Russia, where she was warmly received by the more profligate Catherine II. When the queen told her, in answer to her exorbitant demands, that she asked more money for a month's singing than a Russian field marshal received for a month's service in the field, she suggested that the queen might get her marshals to sing. She did not venture to appear in England, where she feared her strange manners might meet with rebuke. She sang for the last time in Milan, where her rivalry with Marchesi was so keen as to lead to popular disturbances. Her declining years were spent in retirement at Rome.

GACHARD, LOUIS PROSPER, principal archivist of Belgium, was b. in France about the year 1800. He was originally a compositor, but having removed to Belgium, he took part in the revolution of 1830, and was naturalized in 1831. In the same year he was appointed to the honorable post of keeper of the public records. G. has spent much time in examining the documents relating to Belgian history, which are to be found in the national archives and in those of Spain. His principal writings are: *Analectes Belgiques* (1830); *Documents Politiques et Diplomatiques sur la Révolution Belge de* 1790 (1834); *Mémoires sur les Bollandistes et leurs Travaux depuis* 1773 *jusqu'en* 1789 (1847); *Correspondance de Guillaume le Taciturne* (1847–51); *Correspondance de Philippe II., sur les affaires des Pays-Bas* (1848–51); *Correspondance du Duc d'Albe sur l'Invasion du Comte Louis de Nassau en Frise* (1850); *Retraite et Mort de Charles-Quint* (1854); and *Relation des Troubles de Gand sous Charles-Quint* (1856). Prescott speaks highly of his history of

Charles V. In 1859, G. published historical documents bearing unfavorably upon the characters of counts Egmont and Horn, which had the effect of stopping the erection of a monument to them. He issued, in 1863, *Don Carlos et Philippe II.;* in 1866, *Actes des Etats Généraux des Pays Bas;* in 1867, *Correspondance de Marguerite d'Autriche avec Philippe II.;* and, in 1869, *Jeanne la Folle.* In the same year, G. published *La Bibliothèque des Princes Corsini à Rome.*

GAD, the first-born of Zilpah, Leah's maid, was the seventh son of Jacob. His name is differently explained.—The *tribe* of G. numbered in the wilderness of Sinai more than 40,000 fighting-men. Nomadic by nature, and possessing large herds of cattle, they preferred to remain on the e. side of Jordan, and were reluctantly allowed to do so by Joshua, on condition of assisting their countrymen in the conquest and subjugation of Canaan. Their territory lay to the n. of that of Reuben, and comprised the mountainous district known as Gilead, through which flowed the brook Jabbok, touching the sea of Galilee at its northern extremity, and reaching as far e. Rabbath-Ammon. The men of G.—if we may judge from the eleven warriors who joined David in his extremity—were a race of stalwart heroes; "men of might, and men of war fit for the battle, that could handle shield and buckler, whose faces were like the faces of lions, and were as swift as the roes upon the mountains" (1 Chron. xii. 8). Jephthah the Gileadite, Barzillai, Elijah the Tishbite, and Gad "*the* seer," were also in all probability members of this tribe.

GADA'MES, or more accurately GHADAMES (the *Cydamus* of the Romans), the name of an oasis and town of Africa, the center of divergent routes to Tunis, Tripoli, Ghat, and Tidikelt, is situated on the northern border of the Sahara, in lat. 30° 9′ n., long. 9° 17′ e., on the south-western boundary of the pashalic of Tripoli, and 310 m. s.w. of the town of that name. It contains six mosques and seven schools; but the education offered to the young is limited to the reading of the Koran and a little Arabic writing. The gardens of G. grow dates, barley, wheat, millet, etc., and are watered by the hot spring (89° Fah.), from which the town had its origin. The climate is dry and healthy, though very hot in summer. The revenue of G., estimated at 10,000 mahboobs (£1700), is derived from annual tributes levied on property, and from custom dues and tolls. It is an important entrepôt for manufactures and foreign goods from Tripoli to the interior, and for exports of ivory, bees-wax, hides, ostrich feathers, gold, etc., from the interior to Tripoli. Previous to 1856, about 500 slaves, principally females, were annuolly imported at G.; but in that year a decree was issued by the sultan, peremptorily forbidding the traffic, which accordingly has been completely abolished. Pop. '60, 7,000, who are devoted Mohammedans.

GAD'ARA, an ancient city of Syria, 8 m. s.e. of the sea of Galilee, on the banks of the Hieromax. The neighborhood Um Keis, formerly Gadara, is marked by extensive ruins, which support the statements of Josephus and Polybius, that G. was the capital of Peræa, and one of the most strongly fortified places in the country. Traces of the walls can be found for a circuit of about 2 m.; one of the principal streets was bordered on both sides by colonnades; but perhaps the most noticeable of the ruins are two theaters. The cliffs around the town abound in tombs excavated in the limestone rock, and by a curious irony of fate these chambers of the dead are the only places where a living inhabitant of G. is to be found. According to Josephus, G. was a Greek city, and probably a foreign settlement. The name does not occur in the Scriptures; but in the New Testament, the phrase "the country of the Gadarenes" is used more than once, and there is no reason to doubt that it was in the vicinity of the town that the demoniacs were healed by the Savior. G. was captured by Antiochus in 218 B.C., and some twenty years afterwards, stood a ten months' siege by Alexander Jannæus. It was twice taken by Vespasian, in spite of the stout resistance offered by the Jewish inhabitants. At a later period, it became one of the most beautiful and flourishing cities of Syria; but after the Mohammedan conquest it fell once more into decay.

GADDI, AGNOLO, son of Taddeo, 1342–90. He was a painter and mosaist, trained by his father, and, in middle age, a merchant in Venice, where he gained riches. His early paintings show much promise, hardly fulfilled in later years. One of the earliest, at St. Jacopotra' Fossi, Florence, represents the resurrection of Lazarus. Another probably youthful performance is a series of frescos in the Pieve di Prato—legends of the Virgin and of her sacred girdle; the marriage of Mary is one of the best. In St. Croce, he painted, in eight frescos, the legend of the cross, beginning with Michael the archangel, giving Seth a branch from the tree of knowledge, and ending with the emperor Heraclius carrying the cross as he enters Jerusalem; in this picture is a portrait of the painter himself. Agnolo excelled Taddeo in composition of subjects, and in dignity and individuality of figures, and was a clear and bold colorist; the general effect is laudably decorative, but the drawing is poor, and his works require a distant view.

GADDI, GADDO, 1239–1312; a Florentine painter and worker in mosaics, said to have executed the great mosaic inside the portal of the cathedral of Florence representing the coronation of the Virgin; and more certainly credited with the mosaics inside the portico of the basilica of St. Maria Maggiore, Rome, relating to the legend of the foundation of that church, probably of the date of 1308. In the original cathedral of

St. Peter in Rome, he also executed the mosaic of the choir, and those of the front, representing on a colossal scale God the Father, with many other figures; together with an altar-piece in the church of St. Maria Novella, Florence. These works no longer exist. Some other extant mosaics are attributed to him, but without authentication. This artist laid the foundation of a very large fortune, whose increase placed his progeny in a distinguished worldly position.

GADDI, TADDEO, 1300-66; son of Gaddo; a Florentine artist, became one of Giotto's assistants. He was a painter, mosaist, and architect. He executed in frescos for the Baroncelli chapel, in the Florentine church of St. Croce, "The Virgin and Child between Four Prophets," on the funeral monument at the entrance; and on the walls various incidents in the legends of the Virgin, from the expulsion of Joachim from the temple to the nativity of Christ. His "Presentation of the Virgin in the Temple" contains the two heads which have been traditionally accepted as portraits of Gaddo Gaddi and Andrea Tafi. On the ceiling of the same chapel are "The Eight Virtues." In the museum of Berlin is an altar-piece by Taddeo; "The Virgin and Child;" and some other subjects, dated 1334; in the Naples gallery, a triptych, dated 1336, of "The Virgin enthroned with Four Saints," "The Baptism of Jesus," and his "Deposition from the Cross;" in the sacristy of St. Pietro a Megognano, near Poggibonsi, an altar-piece dated 1335, "The Virgin and Child enthroned among Angels." A series of paintings, partly from the life of St. Francis, are now divided between the Florentine academy and the Berlin museum; the compositions are taken from or founded on Giotto, to whom, indeed, the Berlin authorities have ascribed their examples. His figures are vehement in action, long and slender in form; his execution is rapid and somewhat conventional. To Taddeo are generally ascribed the celebrated frescos on the ceiling and western wall in the "*Cappella degli Spagnuoli*," in the church of St. Maria Novella, Florence. Three pictures in the London national gallery are doubtfully ascribed to him. As a mosaist, he left some works in the baptistery of Florence. As an architect, he supplied in 1336 the plans for the present Ponte Vecchio, and those for the original (not the present) Ponte St. Trinita; in 1337, he was engaged on the church of Orsan-Michele; and he carried on after Giotto's death the work of the unrivaled Campanile.

GADE, NIELS WILHELM, b. Denmark, 1814; an eminent composer. In 1841, he took the prize offered by the Copenhagen musical association, by his first great composition, *Nachklänge von Ossian*. Supported by the king, he proceeded in 1843 to Leipsic, to complete his musical education; and the next year he undertook, in the absence of Mendelssohn, the direction of the Gewandhaus concerts. In 1850, he settled in Copenhagen, where he became organist, director of music, and master of the chapel royal. He was elected one of the foreign members of the Berlin academy of arts in 1874; and in 1876, the Danish folkething voted life pensions of 3,000 crowns to the two most eminent musical composers, and selected G. as one. In addition to his prize compositions, he has written five symphonies, a quintette and an octette, and several vocal pieces with orchestra, among them the well-known *Erl King's Daughter;* the *Springtide Phantasy;* and many smaller compositions.

GAD-FLY. See BOT and TABANUS.

GADIDÆ, an important family of malacopterous fishes, having a moderately elongated body covered with small soft scales, the head naked, the fins all soft and destitute of spines, the ventral fins placed under the throat and pointed, one dorsal fin or more, the air-bladder large. Some of the species are small, but others attain a large size. To this family belong the cod, ling, hake, dorse, haddock, whiting, coal-fish, burbot, etc. The species are widely distributed. Most of them are marine. A few, as the burbot, are fresh-water fishes. The more important species are separately noticed.

GADJATCH', or GADITCH, a t. of s. Russia, in the province of Poltava, and 65 m. E. by W. from Poltava, at the confluence of the Khoral with the Psiol. It has seven churches and a monastery, and an active trade in agricultural produce. Pop. '67, 7,110.

GADSDEN, a co. in n. Florida, on the Georgia border, on the Appalachicola and Ocklokonnee rivers, crossed by the Jacksonville, Pensacola, and Mobile railroads; about 400 sq.m.; pop. '70, 9,802—6,038 colored. The surface is uneven, and the soil fertile. Cotton and corn are the chief productions. Co. seat, Quincy.

GADSDEN, CHRISTOPHER, 1724-1805; b. Ga.; an early and strenuous advocate of the independence of the colonies. He was a member of the body which met in New York in 1765 to oppose the stamp act, and in 1774 was in the first continental congress, where he urged an attack upon the British troops in Boston. He was a brig.gen.; was engaged in the siege of Charleston; and was one of the makers of the constitution of South Carolina. As lieut.gov., he signed the capitulation when Charleston was captured by sir Henry Clinton. He and 77 others were immediately arrested, in violation of the terms of surrender, and Gadsden, refusing all terms of parole, was kept prisoner in the castle of St. Augustine for nearly a year. After peace, he was in the state legislature, where he opposed the confiscation of the property of loyalists. He was chosen governor in 1782, but declined to serve.

GADSDEN, Christopher Edwards, d.d., 1785–1852, b. S. C.; graduated at Yale, and rose through various offices in the Protestant Episcopal church to be bishop of South Carolina, 1840. He was the editor of the *Gospel Messenger*. He was a noble Christian philanthropist, and at all times a devoted friend of the colored race.

GADSDEN PURCHASE, a strip of land embracing 45,535 sq.m. (about the area of Pennsylvania), extending from the Rio Grande del Norte near El Paso westward about 500 m., to the Colorado and the border of Lower California (Mexico); and from the Gila river, which is the n. boundary, to the lines fixed by the treaty of Dec. 30, 1853; the greatest breadth is about 120 miles. Nearly a third of the "purchase" is in New Mexico, and the remainder in Arizona. The transfer to the United States was negotiated with Santa Anna by gen. James Gadsden (1788–1858), a native of South Carolina, who had become prominently known during the second war with England and the Florida Indian war, and who was U. S. minister to Mexico when the purchase was made. The consideration was to be the payment by the United States of $10,000,000, and the relinquishment by Mexico of from $15,000,000 to $30,000,000 of claims for Indian depredations. The transfer was so unpopular in Mexico that it hastened Santa Anna's banishment.

GADWALL (*anas strepera*, or *chauliodus strepera*), a species of duck, not quite so large as the mallard, a rare visitant of Britain, but abundant in many parts of the continent of Europe, and equally so in Asia and in North America. It is also found in the n. of Africa. Being a bird of passage, it is a native both of arctic and of tropical regions. The G. breeds in marshes, and lays from seven to nine eggs. Except at the breeding season, it is usually seen in small flocks, and an individual is sometimes to be found in a flock of other ducks. Its voice is loud and harsh. It is much esteemed for the table, and is common in the London market, being imported chiefly from Holland.

GÆA, or Ge, according to the Greek mythology, the goddess of the earth, appears in Hesiod as the first-born of Chaos, and the mother of Uranus, Pontus, and many other gods and titans. As the vapors which were supposed to produce divine inspiration rose from the earth, it was natural that G. should be regarded as an oracular divinity; and, in fact, the oracles at Delphi and Olympia were believed to have belonged to her in the earlier ages of their history. Her worship extended over all Greece, and she had temples or altars in most of the important cities. At Rome, G. was worshiped under the name of *Tellus*.

GAELIC LANGUAGE and **LITERATURE.** The term Gaelic (Gwyddelian or Gadhelic) is used in two senses. In its wider signification, it designates the northern branch of the Celtic languages, comprehending the Irish, the Highland-Scottish, and the Manx. See Celtic Nations and Irish Language and Literature. In its narrower signification, it designates the Highland-Scottish dialect, also known by the name of Erse or Irish. Mr. W. F. Skene, one the latest and best informed writers on the subject, holds that the differences between the language spoken by the Scotch Highlanders and the language spoken by the native Irish are (1) "partly in the *pronunciation*, where the accentuation of the language is different, where that peculiar change in the initial consonant, produced by the influence of the previous word, and termed by the Irish grammarians eclipsis, is unknown except in the sibilant, where the vowel sounds are different, and there are even traces of a consonantal permutation; (2) partly in the *grammar*, where the Scottish Gaelic prefers the analytic form of the verb, and has no present tense, the old present being now used for the future, and the present formed by the auxiliary verb, where the plural of one class of the nouns is formed in a peculiar manner, resembling the Anglo-Saxon, and a different negative is used; (3) partly in the *idioms* of the language, where a greater preference is shown to express the idea by the use of substantives, and the verb is anxiously avoided; and (4) in the *vocabulary*, which varies to a considerable extent, where words now obsolete in Irish are still living words, and others are used in a different sense."—*The Dean of Lismore's Book*, introd. pp. xiv. xv. (Edin. 1862).

The origin of the differences thus described is a question still in dispute. Mr. Skene contends that they are ancient, and enter into the organization of the language. The Irish scholars, on the other hand, hold that they are comparatively modern and unimportant, and little more than provincial corruptions of the mother-language of Ireland. The late Mr. Richard Garnett, one of the most learned of English philologists, is on the Irish side, holding "that Irish is the parent tongue, that Scottish Gaelic is Irish stripped of a few inflections, and that Manx is merely Gaelic with a few peculiar words, and disguised by a corrupt system of orthography;" and, again, that the language of the Scottish Highlands "does not differ in any essential point from that of the opposite coast of Leinster and Ulster, bearing, in fact, a closer resemblance than Low German does to High German, or Danish to Swedish."—*Philological Essays*, pp. 202, 204 (Lond. 1859). That the n. of Ireland, and the Scottish Highlands and West islands, were, at an early period, peopled by the same race, or races, is admitted on both sides. Mr. Skene further admits, that from about the middle of the 12th c. to about the middle of the 16th c., Ireland exercised a powerful literary influence on the Scottish Highlands; that the Irish sennachies and bards were heads of a school which included the West

Highlands; that the Highland sennachies were either of Irish descent, or, if they were of native origin, resorted to bardic schools in Ireland for instruction in the language and the accomplishments of their art; that in this way the language and literature of the Scottish Highlands must have become, by degrees, more and more assimilated to the language and literature of Ireland; and that it may well be doubted whether, towards the middle of the 16th c., there existed in the Scottish Highlands the means of acquiring the art of writing the language except in Ireland, or the conception of a written and cultivated literature, which was not identified with the language and learning of that island. Mr. Skene holds, at the same time, that a vernacular Gaelic, preserving many of the independent features of a native language, existed among the Scottish Highlanders as a spoken dialect; and that a popular and unwritten literature existed in that native and idiomatic Gaelic, in the poetry handed down by tradition, or composed by native bards innocent of all extraneous education in the written language of Ireland.

The first books printed for the use of the Scottish Highlanders were a translation of Knox's prayer book in 1567, by John Carsewell, bishop of the Isles; a translation of Calvin's catechism, in 1631; a translation of the psalms of David, begun in 1659, and completed in 1694; and a translation of the Bible, published by the Rev. Robert Kirke, minister of Balquhidder, in 1690. All these works are in the Irish orthography and Irish dialect; the last-mentioned work, indeed, is nothing more than a reprint of bishop Bedell's Irish version of the Bible, with a short vocabulary of Scottish Gaelic words, to adapt it to the use of the Scottish Highlanders.

The first translations into the Scottish Gaelic were of Baxter's *Call to the Unconverted*, published in 1750; of the psalms of David, in 1753, in 1787, and in 1807; of the New Testament, in 1767 and 1796; of Alleine's *Alarm*, in 1781; of the Old Testament, in 1783–87, and in 1820; and of the Old and New Testaments, in 1826

Vocabularies of the Scottish Gaelic were published in 1690, in 1702, in 1741, in 1795, and in 1815. The first dictionary, by R. A. Armstrong, appeared in 1825; the largest and best was published under the auspices of the Highland society of Scotland, in two quartos, in 1828. The best grammar is that of the Rev. Alexander Stewart, minister at Dingwall, published in 1801, and reprinted in 1812.

The oldest specimen of the written language connected with Scotland is the *Book of Deer* (see DEER), compiled in the 12th century. The written language had, however, disappeared in Scotland during the next three centuries; as the oldest collection of *poetry* in the Scottish Gaelic, preserved in *The Dean of Lismore's Book*, compiled between 1511 and 1551, by sir James Macgregor, vicar of Fortingall, and dean of Lismore, is written phonetically. It is now in the Advocates' library at Edinburgh. Selections from it have been published at Edinburgh (1862), with translations by the Rev. Thomas M'Lauchlan, as well into English as into modern Scottish Gaelic, and with a preliminary dissertation by Mr. W. F. Skene. The volume contains nine pieces ascribed to "Ossian, the son of Finn," who speaks of himself as contemporary with St. Patrick, and pieces by later and less known writers. The literary merit of the compositions is very slender.

The bibliography of the scanty literature of the Scottish Gaelic will be found in Reid's *Bibliotheca Scoto-Celtica* (Glasgow, 1832). As an exposition of the philology of the Gaelic language, and as an introduction to Gaelic literature and the Ossianic controversy, the English reader will find prof. Blackie's *Language and Literature of the Scottish Highlands* (1876) an interesting, instructive, and impartial guide. The traditional prose literature of the language has been collected and illustrated by Mr. J. F. Campbell, of Islay, in four pleasing volumes, *Popular Tales of the West Highlands* (Edinburgh, 1860–62), in which the Gaelic original is accompanied by an English translation.

Mr. Skene has very clearly and fairly stated the long-disputed question as to the authenticity of the famous poems of Ossian, published first in English, and afterwards in Gaelic, by Mr. James Macpherson. The conclusions arrived at are: 1. That the characters introduced into Macpherson's poems were not invented by him, but were really the subjects of tradition in the Highlands; and that poems certainly existed which might be called Ossianic, as relating to the persons and events of that mythic age. 2. That such poems, though usually either entire poems of no very great length, or fragments had been handed down from an unknown period by oral recitation, and that there existed many persons in the Highlands who could repeat them. 3. That such poems had likewise been committed to writing, and were to be found to some extent in manuscripts. 4. That Macpherson had used many such poems in his work; but by joining separated pieces together, and by adding a connecting narrative of his own, had woven them into longer poems, and into the so-called epics.

The Scottish Gaelic speech is everywhere gradually, and in some places rapidly, losing ground; but it is still used, wholly or partially, in the public religious services of about 180 out of about 1000 congregations of the church of Scotland.

GAETA (the Cajeta of the Latins), a strongly fortified maritime town of southern Italy, in the province of Caserta, is picturesquely situated on an abrupt promontory projecting into the Mediterranean, and connected with a mainland by a low and narrow isthmus protected by solid walls. On the summit of the promontory stands the circular tower D'Orlando, said to be the ancient mausoleum of Lucius Munatius Plancus.

the friend of Augustus. The beauty of the bay of G., which almost rivals that of Naples, has been celebrated by Homer, Virgil, and Horace. Cajeta, the ancient name of G., derives its origin, according to Virgil, from its being the burial-place of Cajeta, the nurse of Æneas. On the dismemberment of the Roman empire, G. became a center of civilization and commercial prosperity, and reached still further importance after the decadence of the eastern empire. In the growth of this early municipality is foreshadowed the commercial life and grandeur of the later Italian republics. Both in ancient and modern times, G. has sustained remarkable sieges, and recently it has been the theater of several interesting events. In 1848, it became the refuge of pope Pius IX., when the revolution at Rome compelled him to retire. In 1860, after the defeat of the Neapolitans on the Volturno by the forces of Garibaldi, G. was the last stronghold of the Bourbon dynasty of Naples, and surrendered after a protracted siege to gen. Cialdini. Many interesting classic remains have been found in G., including a fine marble vase by the Athenian sculptor Salpione. Its vicinity abounds in remains of Roman villas, etc. The citadel, which is of great strength, contains in its tower the tomb of the constable Bourbon, killed at the taking of Rome in 1527. The inhabitants of G., who number about 18,000, derive their chief profits from the fisheries and their coasting-trade in oil, wine, and fruit—the chief productions of the surrounding country,

GÆTU'LIA, an ancient country of Africa, situated s. of Mauritania and Numidia, and embracing the western part of the desert of Sahara. Its inhabitants belonged to the great aboriginal Berber family of north and north-western Africa; they were not in general black, though a portion of them dwelling in the extreme s. towards the Niger, had approximated to this color through intermixture with the natives and climatic causes, and were called *Melanogætuli*, or "Black Gætulians" (see Ptol. iv. 6, s. 16). The Gætulians were savage and warlike. They came into collision with the Romans for the first time during the Jugurthine war, when they served as light-horse in the army of the Numidian king. Cornelius Cossus Lentulus led a force against them, and for his success claimed a triumph and the surname of Gætulicus (6 A.D.). The ancient Gætulians are believed to be represented in modern times by the Tuaricks or Tawâreks.

GAFF, in a ship or boat, the spar to which the head of a fore-and-aft sail is bent, such sail having its foremost side made fast by rings to the mast, and its lower edge, in most instances, held straight by a boom. The thick end of the gaff is constructed with "jaws" to pass half round the mast, the other half being inclosed by a rope; this serves to keep it close when the sail is hoisted or lowered.

GAFFLES, a name applied to the levers by means of which cross-bows were bent.

GAGARIN, an important princely family of Russia, of which some of the principal members were: MATTEI PETROVITCH, governor of Siberia, who suffered death in 1721 by order of Peter the great on suspicion of aspiring to an independent sovereignty; ALEXANDER IVANOVITCH, distinguished in the Crimean war, assassinated by the prince of Suanethi, whose province he was trying to annex to Russia; PAVEL PAVLOVITCH, a member of the council of emancipation, and, 1864–69, president of the council of ministers; IVAN, a Jesuit missionary and author of many ecclesiastical books and pamphlets, secretary to the Russian embassy in Paris, who founded in Constantinople the society of St. Dionysius the Areopagite with the object of reuniting the Greek and Latin churches.

GAGE, a co. in n.e. Nebraska, on the Kansas border, intersected by Big Blue river, and traversed by the Omaha and Southwestern railroad; about 900 sq.m.; pop. '70, 3,359–'76, 6,021. The surface is undulating and the soil is well adapted to cattle raising. Wheat, corn, oats, and hay are the leading products. Co. seat, Beatrice.

GAGE (Lat. *vadium* or *wadium*) signifies a pawn or pledge, and is derived, says Cowel, from the French *gager*. Hence, by changing *g* into *w*, we have *wage* and *wager;* as "wager of law," "wager of battle," wherein a person gave his pledge that he would sustain his affirmation; and, in the latter case, the glove was sent as a material pledge to be redeemed by mortal combat. Hence also in England.

Estate in gage, which was of two kinds—*vivum vadium*, and *mortuum vadium*. See MORTGAGE. *Vivum vadium* was where an estate in lands was given in security of a debt, on condition that the estate should remain with the lender until he had made good the sum lent out of the profits of the land. So as in this case neither money nor land dieth or is lost, and therefore it is called *vivum vadium* (Co. Litt. 205 a). This mode of giving security has long gone out of use; yet there is no doubt that it was the original method in observance before the transaction assumed the form of a mortgage. It exactly corresponds with the Scotch form of a pure wadset (q.v.).

GAGE, FRANCIS DANA, b. Ohio, 1808; daughter of Joseph Barker and wife of J. L. Gage. She distinguished herself by lecturing in advocacy of total abstinence and of woman's rights, and was a strong opponent of slavery. She removed to St. Louis in 1853 and suffered the usual persecutions bestowed upon all prominent abolitionists. Returning to Ohio, she occupied the position of editor. During the war of the rebellion, she gave her services in caring for the sick and wounded of the union army. She is widely known as the writer of pieces for the young under the signature of "Aunt Fanny."

GAGE, Thomas, an English gen., who in 1760 became governor of Montreal, and in 1763 commander-in-chief of the British forces in America. His inflexible character led the government to regard him as well fitted to end the disturbances in the American colonies. In 1774, he was elected governor of Massachusetts, a post of peculiar difficulties. Appointed to carry out those rigorous decrees of parliament which ultimately alienated the colonies from the mother country, he proceeded to enforce them, but in such a manner as only tended to widen the gulf of separation, and drive matters to a climax. On April 18, 1775, he dispatched an expedition to seize a quantity of arms which had been stored at Concord. On the way thither the detachment came upon a number of militia drilling, whom they attacked because they refused to lay down their arms. This encounter, known as the battle of Lexington, was the signal for a general rising throughout the states. On June 17, the battle of Bunker's hill was fought, which resulted in a dearly bought victory to the English, but numerous complaints being lodged against G., he was recalled by the British government in Oct., 1775. He then returned to England, where he died in 1787.

GAGERN, Heinrich Wilhelm August, Freiherr von, was b. at Baireuth, Aug. 20, 1799, and educated at the military school of Munich. On Napoleon's return from Elba, G. entered the army of Nassau, and served as lieut. at Waterloo. After the peace, he devoted himself to the study of law at the universities of Heidelberg, Göttingen, Jena, and Geneva. On returning home in 1821, he entered political life under the government of grand-ducal Hesse, and after passing through several public offices, was elected a member of the second chamber in 1832, in which position he vigorously opposed the politics of the governments and of the federal diet. In 1835, the government succeeded in obtaining a majority, but G. continued to be re-elected; until, at the close of the following year, seeing the fruitlessness of his opposition to the governmental politics, he declined re-election, and took a lease of his father's estate at Monsheim, with a view to the practical study of agriculture. In 1846, G. again appeared before the public in a work against the government of electoral Hesse, which had been legislating in defiance of the constitution of the electorate. In the following year, he was elected into the camber again as representative of Worms, and his return to public life gave such a fresh impulse to liberal politics, that in 1848 the elections returned more opponents of the government than they had done since 1832. The life of G. became now inseparably connected with the memorable German movement of 1848. He took the lead on Feb. 27, by introducing a motion into the chamber to promote the representation of the German people in the Frankfort diet. When the preparatory convention of delegates (*das Vorparlament*) from the German states assembled at Frankfort on Mar. 31, G. took the most prominent part in its deliberations, and on the meeting of the parliament (May 28) (see Germany), he was appointed president, and continued to be re-elected every month till he was called to the perpetual presidency. Displaying more of the qualifications of a practical statesman than were possessed by most of the leading men who joined in this movement, G. struggled on amid all the divisions into which his party separated, and all the difficulties presented by the governments. But unable, on the one hand, to sympathize with the violence of the democratic party, and, on the other, to come to an understanding with the governments, he abandoned the movement altogether on May 20, 1849. In 1850, he served as maj. in the Slesvig-Holstein war, and when the campaign was over, retired to the Monsheim estate, which had now come into his possession by his father's death. In 1852, he removed to Heidelberg. In 1856, he published the life of his brother, gen. Friedrich von Gagern.

GAIL, Jean Baptiste, 1755–1829; b. Paris; eminent as a Greek scholar, and in 1802 professor of Greek literature in the college of France. He published many works on Greek language and literature.

GAIL HAMILTON. See Dodge, Mary Abigail.

GAILLAC, a t. of France, in the department of Tarn, and on the right bank of the river of that name, is situated in a fertile vine-growing district, 32 m. n.e. of Toulouse. It is ill built, and has no public building of any importance except the communal college. Distilling, tanning, ship-building, and a brisk trade in wine and brandy are carried on. Pop. '72, 5,694.

GAILLARD, Edwin Samuel, ll.d.; b. S. C., 1827; educated in the state medical college, traveled in Europe, and settled in New York city, where he gained a prize for an essay on ozone. In the war of the rebellion, he became medical director of the confederate armies. In 1867, he occupied a professor's chair in the medical college of Virginia. Removing to Kentucky, he became professor of the principles and practice of medicine in the Louisville medical college. He has edited the *Richmond and Louisville Medical Journal*, and the *American Medical Weekly*. He lost his right hand in the battle of Seven Pines.

GAILLARD, Gabriel Henri, a French historian, was b. at the village of Ostel, near Soissons, Mar. 26, 1726. He was educated for the bar, but soon abandoned it for literature, and afterwards turned his attention exclusively to history. His first work was entitled *Essai de Rhétorique Française à l'Usage des jeunes Demoiselles*, etc. (1745), and the favorable reception which it met with induced him to publish his *Poétique Française à*

l'Usage des Dames. In 1757, appeared his *Histoire de Marie de Burgogne, Fille de Charles le Téméraire;* which was followed, in 1766, by the *Histoire de François I.*, and in 1782 by the *Histoire de Charlemagne, précédée de Considérations sur la première Race, suivie de Considérations sur la seconde Race, et contenant l'Eloge du Premier President de Lamoignon.* In a diffuse, one-sided, and rhetorical style, he represented the relations of France to England and Spain in his *Histoire de la Rivalité de la France et de l'Angleterre* (1771–77) (which procured his admission into the French academy), and *Histoire de la Rivalité de la France et de l'Espagne.* G. was the author of many other works. He wrote *éloges* on Malesherbes (his intimate friend), Descartes, Charles V., Henry IV., Corneille, Molière, etc. He died Feb. 13, 1806.

GAINES, EDMUND PENDLETON, 1777–1849; b. Va. He served as lieut. in the regular army, and was concerned, while on frontier duty, in the arrest of Aaron Burr. In 1811, he resigned, but when the war with England began he returned to the service, and was in command at fort Erie when the British assault under gen. Drummond was repulsed. Upon this occasion he was wounded, congress presented thanks and a gold medal, and the president made him brevet brig.gen. He was engaged in the Indian wars in Georgia.

GAINES, MYRA CLARK; b. New Orleans, 1805; daughter of Daniel Clark, and widow of gen. Edmund P. Gaines. Her father came from Ireland to New Orleans in 1799, and inherited the property of an uncle. He was U. S. consul while Louisiana was still under French rule. After its transfer to the United States he became its representative in congress. In 1813, he died, leaving a vast property to his mother, Mary Clark. After his decease, it was ascertained that, although he had always declared himself a bachelor, he had privately married a beautiful French woman, the reputed wife of a man then absent in Europe, and by her had two daughters. The youngest, Myra, was adopted by a col. Davis, and took his name, in ignorance of her real paternity. She was principally educated in Philadelphia. In 1832, she married W. W. Whitney, of New York, who had become acquainted with the facts of her birth. Later on, it was further discovered that Clark, a short time before his death, had made a will, bequeathing his estate to Myra, and acknowledging her as his legitimate child. The history of the case is one of the most extraordinary and interesting in American jurisprudence. The result in, general terms, was, first, that the will, though never found, was sustained (1856) in the courts after an enormously expensive contest, in which, through many years, Myra showed dauntless purpose and indefatigable energy; secondly, that her legitimacy was established in the state and United States courts; thirdly, that by decision in equity in the U. S. supreme court (1867) she recovered possession of property in and near New Orleans estimated at $35,000,000. She has been for several years engaged in the tedious process of ejecting those who have long had possession of portions of the estate. A large part of it has now come into her hands. After the death of her first husband, she married gen. Gaines in 1839.

GAINES'S MILL, the name given to a battle fought June 27, 1862, on nearly the same ground as the battle of Cold Harbor two years later. Towards the end of June, 1862, Lee, who had succeeded to the command of the main confederate army, had collected about 100,000 men in and near Richmond. The union forces at the Chickahominy, under McClellan, numbered "present for duty" 115,102. The bulk of this army had been transferred to the right bank (s. side) of the river, and there intrenched, Porter with 27,000 men remaining on the n. side. For many days McClellan had been calling for and receiving reinforcements. After establishing himself on the s. side of the river he sent word, "The affair is over, and we have gained our point fully." An hour later he reported that Beauregard had reached Richmond with a strong force, that Jackson's advance corps was at Hanover court-house, that the confederate forces amounted to 200,000, and there was every probability that they would attack the next morning (June 26). The facts in reality being that Jackson's whole force had reached Hanover court-house, but Beauregard had not been near Richmond, being still in Alabama. At this time the north was awaiting the capture of Richmond, and it was to McClellan that they looked for it. His preparations had been lengthy, but the expected attack was still delayed until Lee anticipated him by striking first (at Mechanicsville) on the afternoon of the 26th. The same night McClellan determined to transfer his operations to the James river. He relinquished his intended attack on Richmond, and organized a retreat. In the course of the night the greater part of the heavy artillery was transferred to the right bank, but fearing that the sudden withdrawal of Porter's force to the same side would expose it to danger in the rear, and hoping to gain time, McClellan decided to resist Jackson with Porter's corps in a new position.

The position selected by him was a circular area from which he could completely command the approaches to the bridge. The left of the line, commanded by Morell, was established in a portion of the woods which lined the left bank of the Gaines's Mill stream, while its flank extended in the direction of the Chickahominy, the river at the time being completely swept by the artillery of the opposing forces. Sykes, who commanded the right of the line, had drawn up his men partly under cover of the woods and partly in the open. The second line comprised McCall's division. To the rear, under cover of a hill, gen. P. St. George Cooke, in command of the cavalry, kept guard over the left flank, and commanded the approach by the river. The confederates soon

discovered the change of tactics, and started in hot pursuit, and towards noon a slight encounter took place at Gaines's Mill. At 2 P.M., the division under A. P. Hill, which had been delayed while waiting for Johnson, commenced the attack near Cold Harbor; but Sykes's division repulsed them with heavy loss. Lee, seeing the disadvantage of Sykes's position, and anxious to relieve him, ordered a feint on the union left, but Longstreet, the officer to whom he intrusted it, considered an attack in force desirable. The arrival of Jackson on the union right made a general engagement inevitable.

By 3 o'clock, it was necessary to bring up reserves, against the repeated attacks upon the union front. Porter dispatched orders for reinforcements, which, however, did not reach him until 3.30, when Slocum's division reached the scene of action, bringing up the efficient numbers to 35,000, opposed to a force numbering double that amount.

By 5 P.M., Porter reported himself as so little able to maintain his position that two divisions were told off to his assistance.

On the right, meanwhile, Sykes's division, already reinforced by Bartlett's brigade, held its ground well for some time, but at last the force brought against it was so overwhelming, that the lines were completely broken.

Porter now had recourse to his artillery, and had nearly accomplished a successful withdrawal of his remaining force, when gen. Cooke attacked the confederate force on the left. A withering fire replied; the horses, completely unmanageable, wheeled round, and dashed up the incline, thus throwing the gunners into the greatest confusion, as they imagined that the attack came from the enemy, and, losing their presence of mind, hastily withdrew their batteries.

The confederates now charged with great energy and fire, and, carrying all before them, captured 14 guns, and drove the union left back on the Chickahominy. The most important point of the line thus carried by assault, the right was forced to retreat, adding still more to the panic and confusion. Things were thus critical when the fortunes of the field wavered once more, as reinforcements under French and Meagher reached the ground and made their way impulsively to the front, while the retreating forces, once more encouraged, advanced in readiness for another attack. But the gathering darkness prevented Lee from following up his advantage. During the night, the union forces crossed the river, destroying the bridge behind them at 6 on the morning of the 20th.

McClellan, meanwhile, had remained with his forces on the s. side of the river, opposed to Magruder, who, in charge of only 25,000 confederates, had contrived, by simulated noise and excitement, to convey the impression that their number was much larger, thus inducing the union commander to remain inactive in expectation of an attack, which Magruder of course was equally anxious to avoid. Thus it came about that while Porter, with only 35,000, was striving against double his numbers, 25,000 men on the s. side of the river held a body of men at least twice as strong as themselves in check.

In this engagement the unionists lost 6,000 men and 22 guns, while the confederate loss amounted to 9,000.

GAINSBOROUGH, a market-t. and seaport of England, in the co. of Lincoln, is situated on the right bank of the Trent, about 20 m. above the embouchure of that river in the Humber mouth, and 16 m. n.w. of Lincoln. It is a well-built town, consisting mainly of one long street, running parallel with the river, which is here spanned by a fine stone bridge of three elliptical arches. It was constituted a port in 1841. The most interesting of the buildings of G. is that called the old hall or manor house, a portion of which has recently been converted into a corn exchange. It is said to have been occupied, or held in property, by the several lords of the manor of G. ever since the Saxons established themselves in this neighborhood. Among the other public buildings are the parish church—which, with the exception of a fine old tower, dating from the 12th c., was rebuilt in 1736—and the town-hall. There are also a grammar-school, established in 1589, and other educational institutions; a literary institute and several libraries. G. is favorably situated in a commercial point of view, sea-going vessels being able to reach its wharves by the river, while by means of the Keadby, the Chesterfield, and other canals, it maintains communication with the interior of the country. Vessels drawing 12 ft. of water can ascend the Trent to the town. G. has important manufactures of linseed oil, and carries on malting, rope-making and ship-building extensively. Pop. (1871) of township, 7,564.

GAINSBOROUGH, THOMAS, one of the most eminent English landscape-painters, was b. at Sudbury, in the co. of Suffolk, 1727, and early displayed a decided talent for painting. "Nature," it has been said, "was his teacher, and the woods his academy, where he would pass his mornings alone, making sketches of an old tree, a marsh, brook, a few cattle, a shepherd and his flock, or any other objects that casually came in view." At 14 years of age, he was sent to London, where he was for some time with Mr. Gravelot, the engraver, and afterwards with Hayman. At 19, he married, and set up in Bath as a portrait-painter, in which capacity he was very successful; but his genius first found adequate expression in the delineation of the rich and quiet scenery of his native country, and to this he mainly devoted himself after leaving Bath for London, in 1774. On

the institution of the royal academy, G. was chosen one of the first members, but never took much interest in its proceedings. He died Aug. 2, 1788, of a cancer in the neck. His last words exhibited more the enthusiasm of the painter than the logic of the theologian: "We are all going to heaven, and Vandyck is of the party." G.'s portraits are remarkable as "striking likenesses," but are not carefully finished. The best are those of the royal family, of Abel the composer, and Quin the actor. His fame, however, rests chiefly on his landscapes; in these, he shows himself a faithful adherent to nature, as he knew it in his own beautiful island. He is, in fact, to be regarded as the first truly original English painter, and, in the opinion of sir Joshua Reynolds, fit to be the head of an English school. Among his finest productions are "The Shepherd's Boy," "The Fight between Little Boys and Dogs," "The Seashore," and "The Woodman in the Storm." His most celebrated picture is "The Blue Boy," in the Devonshire gallery.

GAIRDNER, WILLIAM, 1793–1867; b. Scotland; educated in Edinburgh, and graduated as a physician in 1813. After some years on the continent he settled in London and commenced practice. His observations upon the medical uses of iodine excited a good deal of attention, and he published a pamphlet on the subject. He is considered a great authority on gout, and wrote *Gout, its History, Cause, and Cure.*

GAI'SIN, or GAJSSIN, a t. of s. Russia, in the government of Podolia, 172 m. n. by w. from Odessa. Pop. '67, 9,671.

GAISSIN, GAICYN, or HAISCIN, a t. in Russia, 178 m. e. of Kamenetz Podolski; pop. '78, 9,417. With few exceptions, the houses are built of wood, and the inhabitants are mainly supported by agriculture. Among the public buildings are an orthodox church, a synagogue and four Jewish chapels, and a town hospital. G. dates from about 1600; it obtained Magdeburg rights in 1744 or 1745; and in 1796, after the incorporation of Podolia with Russia, it was made a district town.

GAIUS, a Roman jurist, most probably of the age of the Antonines, and the chief source of our knowledge of Roman law prior to Justinian. Considering the important place which he holds in ancient legal literature, it is strange that his personal history should be almost entirely unknown, and that almost every circumstance connected with him should be a subject of controversy. The discussion as to whether the name is properly *Gaius* or *Caius* is a mere verbal dispute; but the questions regarding his country, his condition, and even his religion, have been canvassed at considerable length. From his being uniformly called by the single appellation G., it has been inferred that he was either a foreigner or a freedman: from his familiarity with the Greek language, some have argued that he was of Greek origin; from his being cited as "our" G. by Justinian, who was a native of Illyricum, it is argued by some that G. must have been an Illyrian by birth; while others, arguing from the same fact, and from other equally inconclusive data, have even set him down as a Christian. That the last inference is a false one, cannot admit of a moment's doubt: the others, even if it were possible to settle them definitively, are of no practical importance. As to the precise age of G., this much is certain, that before the revision of the Roman laws, and the reform of the legal studies by Justinian, the *Institutions* of G., as well as four other of his treatises, were the received text-books of the schools of law. His *Institutions*, moreover, formed the ground-work of the *Institutions* of Justinian. From his being thus preferred to Ulpian or Papinian, it is not to be inferred that he lived after them, but only that his work was more popular. The latest jurist whom he cites is Salvius Julianus, who lived under Hadrian, and the latest imperial edict is one of Antoninus Pius, whence it may fairly be concluded that he survived Antoninus, and probably wrote under his successor.

The works of G. were largely used in the compilation of the *Digest*, which contains no fewer than 535 extracts from his writings. The principal are, the *Edictum Provinciale*, in thirty-two books; the *Aurea*, in seven; the *Edictum Urbicum; On Trusts; On Mortgages;* and, above all, the *Institutions*, in four books. The last-named work is that by which G. is chiefly known, and it was probably the earliest complete and systematic text-book of Roman law. Athough it was the basis of Justinian's *Institutions*, both as to its matter and its division, yet it was completely superseded by that work, and after a time was entirely lost, the only knowledge of it which remained being that which was gathered from the detached extracts in the *Digest*, and from the *Breviarium Alaricianum*, or code of the Visigoths, which was known to be derived from it. The recovery of this long-lost work, therefore, would in any circumstances be considered a fortunate event; but the *Institutions* of G. draw additional interest from the remarkable manner in which it has been restored to literature. It had long been known that the MSS. in the library of the chapter of Verona were specially curious in the matter of jurisprudence; and in 1816. Niebuhr, while on his way to Rome, discovered, in a palimpsest MS., the later writing of which was a copy of St. Jerome's epistles, portions of the work of some ancient jurisconsult, the value of which he at once recognized, and the specimen page of which, as copied by him, was soon afterwards pronounced by Savigny to be a portion of the *Institutions* of Gaius. On the publication of his report, the Berlin academy of sciences commissioned two German scholars, Göschen and Hollweg, in 1817, to make a copy of the entire palimpsest, which consists of 127 sheets. It was a work of immense labor. The original writing had been very carefully washed and in many pages scraped

out; the lines of the second writing did not cross the original, as often happens in palimpsests, but ran in the same direction, and frequently over it; while 68 pages of the palimpsest had actually been written three times, G. having been erased to make room for a theological treatise, which in its turn was scraped out to make room for St. Jerome! It reflects no small credit on the skill and patience of the copyists that they succeeded in recovering so much as nine tenths of the entire work, which was published in 1821 by Göschen, and again, after a fresh collation of the MS. by Blume in 1824; a third and much improved edition, by Lachmann, appeared in 1842. A comparative edition of the *Institutions* of G. and of Justinian, by Klenze and Böcking, had appeared at Berlin in 1829.

The *Institutions* of G. are divided into four books, of which the first is devoted to the law of persons, the second and third to the law of things, and the fourth to the law of actions. The first book was translated into German in 1824 by Von Brockdorff, and the entire work has been translated into French three several times—by Baulet in 1826, by Domenget in 1843, and by Pellat in 1844. In England, it has attracted but little notice, except in a few of the critical journals, and there chiefly as a literary curiosity; nor has any English translation of the work hitherto appeared.

The *Lex Romana Wisigothorum*, or *Breviarium Alaricianum*, is in substance a recast of the *Institutions* of G., published in 506 by Alaric for the use of the Roman subjects of the west Gothic kingdom. It is chiefly curious as illustrating the analogies and the discrepancies of Roman and barbarian law, and as supplying the germ of many of the mediæval institutions by which Roman practice was supplanted. See, in addition to the editions of the *Institutions* enumerated above, Huschke, *Zur Kritik und Interpretation von Gaius Institutionen*, in his *Studien des Römischen Rechts;* also Mackeldey's *Lehrbuch des Römischen Rechts;* and Savigny, *System des heutigen Röm. Rechts.*

GALABAT, GALLABAT, or METEMME, a t. in the frontier district of Egypt and Abyssinia near one of the western sub-tributaries of the Atbara, about 100 m. w. of Gondar; pop. of town and district (area about 40 sq.m.) estimated at 20,000. Most of the houses are built in the Abyssinian style, with conical roofs of grass, and the place would be of little importance if it were not the staple market for the exportation of Abyssinian produce across the Egyptian frontier. The people are industrious; and beeswax, coffee, cotton, and hides are the principal articles of legitimate trade; but as recently as 1873, the traffic in slaves was quite as important a department of its commerce. The town and district form a small ethnographical island, peopled by a colony of Tokrooris from Darfur, who, finding the spot a convenient resting-place for their fellow-pilgrims on their way to Mecca and back, obtained permission from the king of Abyssinia to make a permanent settlement. When sir Samuel Baker was at G. in 1862, the sheikh refused to recognize the authority of the viceroy of Egypt; but in 1873, when De Cosson passed through it, the Egyptians had established a camp, surrounded by a strong stone wall, on a hill commanding the town, and acted as masters of the place.

GALAC'TIC CIRCLE (see GALAXY). This circle is to sidereal what the invariable ecliptic is to planetary astronomy, the ground plane of the sidereal system.

GALACTODENDRON. See COW-TREE.

GALACTOM'ETER, or LACTOMETER, a very simple instrument for testing the richness of milk; it consists of a glass-tube, graduated to 100 parts. New milk is poured in up to the top of the graduated part, and allowed to stand; and when the cream has completety separated, the value of its quantity is shown by the number of parts in the 100 which it occupies. Another form of instrument was invented by Döeffel, consisting of a small hydrometer with a scale 2 in. long divided into 20 degrees, the zero being placed at the point to which the instrument sinks in water, and the 20th degree corresponding with the density 1.0383. This instrument is preferred by the continental chemists; and 14° is held to show milk undiluted with water.

GALACZ, an important t. and river-port of Moldavia, the center of the commerce of the whole Roumanian principality, is situated on the left bank of the Danube, about 3 m. below the point where it is joined by the Sereth, and 92 m. from its mouth. It occupies a slope stretching gently down to the river, and is divided into an old and new town, the former consisting mostly of irregular one-storied houses, the latter built more after the fashion of western Europe. With the exception of its churches and the residences of the foreign consuls, G. has no remarkable buildings. But its dock-yard, its large bazaar, its numerous grain-stores, its magazines of eastern wares, and its rich banking establishments deserve notice. It is the principal emporium for the various produce of the Roumanian side of the lower Danube, which is brought down to G. from the interior in bullock-carts, and thence shipped to foreign countries. The only cities on the whole of the great river that carry on a more extensive trade are Vienna and Pesth. The chief exports consist of wheat, wheat-flour, maize, barley, and rye; also of smaller quantities of oats, beans, millet, rape, and linseed. Other articles of produce are soft pine timber and planks, oak staves, tallow, wool, hides, petroleum, spirits, cheese, and salt fish. The increase in the commerce of G. during the last thirty years has been very great. In 1852, the total value of the

exports amounted to £567,000, and of the imports to £442,000; while in 1874, the exports from G. amounted in value to a total of £1,660,401, and the imports to a total of £1,778,426. It is estimated that Great Britain takes about half of the exports, and supplies about a third of the imports. The chief British imports are cotton goods, iron (bars and sheet), coals, coffee, agricultural machinery; and colonial produce, spices, drugs, tea, sugar, etc. In 1874, the number of ships that entered the Danube for G. and the other river-ports of Roumania was 1439, with a burden of 365,525 tons, Great Britain owning more than a third of the tonnage. The pop of G. is estimated at 80,000, and forms a medley of Moldavians, Greeks, Jews, Armenians, Italians, French, English, and Germans. G. is connected by railway with Bucharest (*viâ* Brahilov) and Czernowitz.

GALA'GO (*galago* or *otalicnus*), a genus of mammalia of the lemur family, remarkable for the great length of the hind-legs, and the great size of the ears, which are membranous, and capable of being folded down as in bats. The head is rounded, the muzzle short, the eyes very large; all the feet have five toes; all the nails are flat, except those of the first digits of the hind-feet, which are armed with sharp claws; the tail is very long, and almost bushy. The species are natives of Africa and Madagascar, varying from the size of a rabbit to that of a rat, more or less nocturnal in their habits, very lively and active, feeding partly on fruits and partly on insects; one of them (*G. Senegalensis*) is known in Senegal as the *gum animal*, from living much in acacias, and feeding, or being supposed to feed, on their gum. "These pretty animals have all the activity of birds, leaping from bough to bough. They watch insects flitting among the leaves, listen to the fluttering of the moth as it darts through the air, lie in wait for it, and spring with the rapidity of an arrow, seldom missing their prize, which is caught by their hands." When they leap, they always seize with their hands the branch on which they intend to rest. They make nests of grass and leaves for their young in the branches of trees. They are a favorite article of food in Senegal.

GALAN'GALE, *Alpinia*, a genus of plants of the natural order *zingiberaceæ* or *scitamineæ*, having perennial stems with terminal inflorescence and succulent fruit. The root-stocks possess stimulating properties similar to those of ginger. The true G. is the produce of *A. galanga*, a native of the Eastern archipelago, and cultivated there; having a stem 6 or 7 ft. high, broad leaves, and a branched panicle of greenish-white flowers. The root-stock, when young, yields a kind of arrow-root, and is used as an article of food; it acquires pungency and aromatic properties as it becomes older. G. is much used in the east for the same purposes as ginger.

GALAN'THUS. See SNOW-DROP.

GALAPA'GOS ISLANDS (so named from *galápago*, the Spanish word for *tortoise*) are a volcanic group in the Pacific, situated on or near the equator, and in long. between 89° and 92° w. They are thirteen in number, the largest measuring 60 m. by 15, with an elevation of 4,000 feet. They can hardly be said to be peopled, being visited chiefly for their turtles, which are of enormous size. The ten principal members of the cluster are Albemarle, Indefatigable, Chatham, Charles, James, Narborough, Hood, Barrington, Bindloes, and Abingdon.

GALASHIELS, the chief seat in Scotland of the Scotch tweed manufacture, occupies 2 m. of the narrow valley of the Gala, immediately above the junction of that river with the Tweed. It is 33½ m. s. of Edinburgh, and 4 n. of Melrose on the Waverley line. At its railway station are the junctions of a line to Selkirk, and of one that lies up Tweed valley to Peebles and the Caledonian. In 1630, G. was erected a burgh of barony. By the reform act of 1868, it is now a parliamentary burgh, and along with Hawick and Selkirk sends a member to parliament. It is governed by a council of 15—of whom one is provost and four are bailies. The parliamentary and municipal boundaries are coterminous, but they exclude about one eighth of the population. In 1871, the pop. within the burgh was 9,678, but the pop. of the whole town was above 11,500. The town has no drainage system, and draws its water for domestic purposes chiefly from wells in the alluvial subsoil. Its principal claim is its manufacturing enterprise. It had, in 1873, 20 woolen factories containing 94 "sets" of carding engines, 810 power-looms, 418 hand-looms, 68,800 spindles—employing 3,400 hands, and capable of turning out annually about £450,000 worth of goods. The product is almost exclusively the well-known woolen cloth called Scotch tweed. The mills are almost dependent on steam for motive power. The town has the largest and best appointed skinnery in Scotland. The boundary line between Melrose and G. parishes intersects the town, and the burgh boundaries embrace portions of both parishes. This has been a cause of great confusion in the administration of the public health act, and of the new education act.

GALATA, a suburb of Constantinople (q.v.).

GALATEA. See ACIS.

GALA'TIA was an ancient times the name of a country of Asia Minor, and was so called from a body of Gauls who settled there. In the 3d c. B.C., great hordes of Gauls, under Brennus, invaded Greece. Some of them took possession of Byzantium and the Propontis, passed the Hellespont on the invitation of Nicomedes, king of Bithynia, in

the year 278 B.C., subdued Troas and the n. of Phrygia, and were first checked by Attalus, king of Pergamus, in a great battle about the year 239 B.C., and compelled by him to settle permanently within certain limits. The state of G., which hitherto had had no accurately defined boundaries, was now confined between Paphlagonia, Pontus. Cappadocia, Lycaonia, Phrygia, and Bithynia. It was also called Gallogræcia, and was peopled by numbers of Phrygians, Greeks, and Paphlagonians, as well as Gauls or Celts. The form of government was at first purely aristocratic, but at a later period the twelve tetrarchs who shared the government among them, in conjunction with a senate of 300 members, succeeded in making their dignity hereditary. At length one of them (30 B.C.), supported by Pompey, assumed the title of king. After his death. the kingdom descended to Amyntas, but was shortly after conquered by the Romans. and converted into a Roman province, divided under Theodosius into *Galatia prima*, with the capital Ancyra, and *Galatia secunda*, with the capital Pessinus. The majority of the Gauls of G. retained their old Celtic language as late as the time of Jerome (4th c.), who says that they spoke the same dialect as the people about Treves; and as Jerome had himself lived there, and was a good scholar, he may be regarded as an authority on the subject. G. was twice visited by the apostle Paul.

GALA'TIANS, EPISTLE TO THE. This epistle was written by the apostle Paul during his residence at Ephesus, probably about the year 56 A.D., and is generally reckoned the third or fourth of the Pauline epistles in the order of time. The circumstance which called it forth was the diffusion, throughout the Galatian churches, of Judaistic practices and notions, chief among which stood the famous rite of circumcision, regarded by Paul as the symbol of all that was exclusive, external, merely *ethnical*, and therefore thoroughly antagonistic to the universality of the gospel. Paul had himself been the first to preach Christ in this region, and as the majority of his converts were Gentiles. it would naturally vex him all the more keenly to see them lapsing into practices inconsistent with their new faith, and for which they had not even the excuse that might have been proffered for the Jews, viz., that antiquity had made such customs venerable. It would also appear that the Judaizing adversaries of Paul had been circulating injurious reports concerning himself, hinting that he was no divinely appointed apostle, but at best a mere messenger of the church of Jerusalem, that he had quarreled with Peter, the great apostle of the circumcision, and that he could play "fast and loose" on this very question of circumcision itself. In his reply to the underhand attacks of his calumniators, Paul asserts the truth of his gospel, passionately declaring that he would pronounce a curse on the very angels from heaven, if they would dare to preach another. vindicates his apostleship, and gives the true version of the story of his variance with Peter. He then proceeds to discuss the relation of Judaism to Christianity, and closes with a series of exhortations and admonitions, the first of which is the well-known "Stand fast therefore in the liberty wherewith Christ hath made us free, and be not entangled again with the yoke of bondage" (v. 1). The commentaries on Galatians are very numerous; among others may be mentioned those of Luther, Winer, Rückert. De Wette, Meyer, Ellicott, and Alford.

GALATIANS, EPISTLE TO THE (*ante*), was universally received in the early church as a genuine work of the apostle Paul, and is clearly shown to be such by its contents, style, and manner. In the introduction (i. 1-5) Paul announces to the Galatians his apostolic authority as derived directly from the Lord, and salutes them in the name of the Father and of Christ. In the body of the epistle there is, I. A discussion of the subject which had occasioned it: 1. Paul vindicates his apostolic authority and teaching, by showing that he was sent out neither by the church at Jerusalem. nor by the apostles there, but directly by Christ, who had personally revealed himself to him. Consequently he was fully equal to any of the apostles (i. 6-ii. 21). 2. He shows that justification is by faith in Christ and not by works of the law; that the design for which the law had been given was to convince of sin as well as to restrain from transgression; that it was temporary, while preparatory to the gospel by showing the necessity of a perfect righteousness which only Christ could give. Such being the design of the law, Christians now are freed from it, as a son, on attaining his majority, is freed from tutors and governors (iii.-iv. 7). 3. He condemns the weakness and folly of the Galatians in taking on themselves the yoke of the law which they had never known, and thereby forfeiting the blessings of the gospel which they had so recently obtained (iv. 9-v. 9). II. Practical instructions and exhortations: 1. Instructions concerning the right of Christian liberty; the fulfilling of the law by mutual love; the various works of the flesh; the manifold fruits of the spirit (v. 13-26). 2. Exhortations, to win back the erring; to cherish mutual sympathy and render mutual help; to guard against self-deception; to persevere in well-doing; to do good to all—especially to Christians—in proportion to ability and opportunity. In conclusion, the apostle repeats his confidence in the cross of Christ as the only ground of justification, renews the declaration that according to the teaching of true Christianity outward observances are of no avail without purification of heart and life, and commends the church to the grace of Christ.

GALATI'NA, S. Pietro in Galatina, a t. in the s. of Italy, in the province of Lecce, is situated in a fertile but unhealthy plain, 18 m. s. of the town of Lecce. Some maintain that it is a very ancient place, but there seems no historical ground for the assertion. G. is a thriving commercial town, and possesses fine public edifices and handsome churches. Pop. 8,400. Raimondo Orsino, prince of Taranto, and lord of Galatina, surrounded the town with ramparts, as a tribute to the citizens for having ransomed him from the Turks for 12,000 ducats.

GALATO'NE, a very ancient t. in the s. of Italy, in the province of Lecce, about 9 m. n.e. of Gallipoli, is situated in a very rich but insalubrious plain. Pop. 5,500. In the struggle between Joanna, queen of Naples, and Alfonso, G., having declared for the former, was besieged by Alfonso, and its ramparts destroyed. It has been possessed by several illustrious families.

GALA WATER, a small river of Scotland, 21 m. in length, rises among the Moorfoot hills in Edinburghshire, flows in a s.s.e. direction through a beautiful and romantic country, and, forming in the lower portion of its course the boundary between Selkirk and Roxburgh shires, unites with the Tweed near Abbotsford.

GAL'AXY, The (Gr. *gala, galaktos*, milk), or the Milky-Way, is the great luminous band which nightly stretches across the heavens from horizon to horizon, and which is found, when carefully traced, to form a zone, completely encircling the whole sphere almost in a great circle. At one part of its course, it opens up into two branches, one faint and interrupted, the other bright and continuous, which do not reunite till after remaining distinct for about 150°. This great zone has occupied the same position in the heavens since the earliest ages. The reader will find its course mapped out on any celestial globe, and a verbal account of it in sir John Herschel's *Outlines of Astronomy*, by which we may test the accuracy of the chart. That course, as traced by the naked eye, following the line of its greatest brightness, conforms nearly to that of a great circle, called the Galactic circle, inclined at an angle of about 63° to the equinoctial, and cutting that circle in 0 hours 47 minutes, and 12 hours 47 minutes right ascension. Throughout the space where, as above stated, it is divided into two branches, this great circle is intermediate to the two, lying nearer that which is the brighter and more continuous. The most casual survey of the Galaxy shows that it is wanting in regularity of outline. Besides the two great branches into which it divides, it has many smaller ones which spring out from it. At one point, it diffuses itself very broadly, and opens out into a fan-like expanse of interlacing branches nearly 20° in breadth. At the same point, the branches terminating abruptly, a wide gap presents itself in the zone, on the opposite side of which it recommences its course with a similar assemblage of branches. At other points, its course is described by sir John Herschel as "irregular, patchy, and winding;" while at more than one point, in the midst of its brightest parts, broad dark spaces occur. One of these, known from early times among navigators as the "coal-sack," is a singular pear-shaped vacancy of about 8° in length, and 5° broad, occurring in the center of a bright area overlying portions of the constellations of the Cross and Centaur. The "coal-sack" occupies about half the breadth of this bright space, and presents only one star visible to the naked eye, though it contains many telescopic stars. Its blackness, which attracts the most superficial observer, is thus due to the contrast with the brilliant ground by which it is surrounded.

The G. was examined by sir William Herschel with his powerful telescope, and found to be composed entirely of stars. How a collection of stars can assume such appearances as are presented in the G., is explained in the article stars (q.v.).

GALBA, Servius Sulpicius, Roman emperor from June, 68 A.D., to Jan., 69, was b. Dec. 24, 3 B.C., of a respectable family. He was raised to the consulship in 33 A.D.; and in the administration of the province of Aquitania under Tiberius, of Germany under Caligula, of Africa under Claudius, and of Hispania Tarraconenis, under Nero. he distinguished himself for bravery, strictness, and justice. His friends had urged him, on the death of Caligula, to take possession of the throne, but he continued faithful to Claudius, and therefore stood high in his favor. In 68, Julius Vindex rose with the Gallic legions against Nero, and called on G. to assume the imperial dignity, and thus rid the earth of its oppressor. G., who had been informed that Nero was contriving his death, came forward against him at first as the legate of the Roman people, and it was only when he heard of Nero's death that he proceeded to Rome to take possession of the throne offered him by the Prætorians. G. was now upwards of 70 years old, and it soon appeared that his character had deteriorated, as, indeed, had already been manifested in his later administrations. Indulgence to greedy favorites, ill-timed severity, above all, avarice, which led him to withhold the usual donatives to the troops, made him unpopular. The legions in upper Germany called on the Prætorians to choose another emperor; G. thought to soothe them by adopting Piso as his coadjutor and successor; but he thus offended Otho, who, as administrator of Lusitania, had supported G., and looked to be rewarded. The Prætorians, who had received no donative on occasion of Piso's adoption, were easily excited to insurrection by Otho, and the emperor having gone out to quell the rebellion, was cut down by the soldiers as he crossed the forum.

GALBANUM, a gum resin used in medicine in the same cases as asafetida. It is principally employed in chronic catarrh, and has been given (especially by the Germans) in amenorrhœa and chronic rheumatism. It is generally administered in the form of the *compound galbanum pill*, which contains G., sagapenum, asafetida, myrrh, and soft soap. It is sometimes applied externally in plasters as a mild stimulant in indolent swellings. It is brought from the Levant, and appears in commerce either in tears or in large masses. It is soft, ductile, whitish, or, when long kept, yellowish in color; has a peculiar balsamic odor, and an acrid, bitter taste. Although it has been known from the earliest ages, and is mentioned by Moses (Exod. xxx. 34) under the name *chelbenah* (translated galbanum in the English Bible), it is still uncertain from what plant it is derived. *Galbanum officinale, ferula galbanifera*, and *opoidia galbanifera*, all of the natural order *umbelliferæ*, have, on various grounds, been supposed to be the source of G; and the confidence with which they have been so represented has perhads prevented travelers from making that inquiry into the subject which otherwise they might have made. It is highly probable that G. is the produce of an umbelliferous plant. *Bubon galbanum*, a plant of this order, found at the cape of Good Hope, yields a gum resin very similar to galbanum.

GALE, or Sweet Gale (*myrica gale*), a small shrub of the same genus with the North American candleberry (q.v.), and very nearly allied to it—a native of all the northern parts of the world, growing in bogs and in most gravelly soils, very abundant in some parts of Britain, but very local. It has small lanceolate slightly serrated leaves, which are sprinkled with resinous dots, and emit a most agreeable fragrance. Its berries are small, and sprinkled with golden resinous dots. The northern nations formerly used this plant instead of hops. The leaves were also employed as a remedy for itch, and have the power of keeping away moths. A decoction of them is efficacious against bugs. By distillation they yield a yellow essential oil. In the Highlands of Scotland, beds are often made of the twigs of G., which is there called *nodh*.

GALEN, Christoph Bernhard von, Bishop of Münster, and one of the greatest generals of his time, was b. at Bispink, in Westphalia, Oct. 15, 1600. After completing his studies in the Jesuit college of Münster, and at the universities of Cologne, Mayence, Louvain, and Bordeaux, he held several political offices, and was at last made bishop of Münster, Nov. 14, 1650. The vigor of his administration immediately began to appear in restoring church-discipline, in allaying a famine which prevailed at the time, in promoting trade, and ridding the country of foreign troops. He soon, however, fell into disagreements with the inhabitants of Münster, who, on applying to Holland, received 25,000 guilders to assist them against him; but with the support of 1200 cavalry from the emperor, the bishop reduced the town into submission in 1660, and continued to maintain his ascendency by severe measures. In 1664, on being appointed, along with the markgraf of Baden, director of the military affairs of the Rhenish alliance, he proceeded with most of his own troops to the seat of the war against the Turks. After his return, he entered into alliance with England against the Netherlands, but the war was soon concluded, in conseqence of the treaty brought about by Louis XIV. in 1666. according to which the states-general promised the restoration to the bishop of all his lands. A dispute, however, afterwards arose, and in 1672, G. again went to war with the Dutch in alliance with France. After some successes obtained in union with Turenne, he suffered such a heavy loss during the siege of Coevorden, by a storm which placed his camp under water, that he willingly concluded a treaty with the allies in 1674, in which he promised to give up all his conquests in the Netherlands. In the following year, he changed sides, and entered into alliance with the emperor against the French. By taking part, also, with the king of Denmark and the elector of Brandenburg in the war with Sweden, he added the duchy of Bremen and other places to his possessions. In 1678, he obtained considerable pecuniary compensation for being drawn into war with East Friesland; but while the peace negotiations were going on he died, Sept. 19. The family of G. is one of the oldest in Westphalia, and is at present represented by count Matthias von Galen, whose brother, count Ferdinand, distinguished himself in the Prussian service as an able diplomatist.

GALENA, a thriving city of the United States, North America, is situated in the n. w. corner of the state of Illinois, on both sides of the Galena river, and 3 m. from the junction of that stream with the Mississippi. It is 450 m. n. of St. Louis, and 250 m. n.n.w. of Springfield. The city, owing to the irregularity of the ground on which it is built, has a bold and picturesque appearance. In and around the town, high bluffs, rising frequently to a height of more than 200 ft., everywhere occur. The streets rise in terraces, one above another, communicating by flights of steps; and among the public buildings are numerous churches and schools, a U. S. marine hospital, and a custom-house. G. owes its rapid growth to the rich mines of lead which surround it. In 1872, 75,000 pigs of lead and 4,000 tons of zinc ore were exported from Galena. Copper is also found, though not in great quantity. G. has manufactures of pottery, soap, and candles; it has also lead furnaces, an iron foundry, and machine-shops; breweries, carriage manufactories, furniture manufactories, and numerous mills. Besides lead, it exports horses, cattle, pork, and agricultural produce. In 1819, the first house was built at Galena. Pop. '70, 7,019.

GALENA, a city in Illinois, the seat of justice of Jo Daviess co., a port of delivery, in the center of the lead-mining district, situated on the Fevre river 6 m. above its junction with the Mississippi; at the terminus of the Galena and Southwestern railroad, and on the northern division of the Illinois Central; pop. '80, 7,019. Steam-boats come up to the city, which is built on both sides of the river. The city has a custom-house, a German-and-English normal, and other schools; foundries, machine shops, flouring mills, and many other manufactories. The mining and trade in lead is, however, the chief business.

GALE'NA, or LEAD-GLANCE, a mineral which is essentially a sulphuret of lead, the proportions being 13.3 sulphur, and 86.7 lead; but usually containing a little silver, and sometimes copper, zinc, antimony, or selenium. It is of a lead-gray color, with a metallic luster, is found massive, or sometimes granular, or crystallized in cubes or octahedrons. It is very easily broken, and its fragments are cubical. It occurs in veins, beds, and imbedded masses, often accompanying other metallic ores, in primitive and secondary rocks, but most of all in what is known as transition or mountain limestone. It is found very abundantly in some parts of Britain. Almost all the lead of commerce is obtained from it. It sometimes contains so much silver, that the separation of that metal is profitably carried on. The lead is extracted from it by a very simple process. See LEAD.

GALEN'ICAL—GAL'ENIST, two words having reference to the controversies of the period of the revival of letters, when the authority of Galen was strongly asserted against all innovations, and particularly against the introduction of chemical, or rather *alchemical* ideas and methods of treatment into medicine. The Galenists adhered to the ancient formulas, in which drugs were prescribed, either in substance or in the form of tinctures and extracts, etc.; while the chemists professed to extract from them the essences, or quintessences (*quinta essentia*, the *fifth* essence, supposed to be particularly pure, as requiring five processes to extract it), i.e., substances in small bulk, presumed to contain the whole virtues of the original drugs in a state of extreme concentration, or purified from all gross and pernicious, or superfluous matter. There can be no doubt, nowadays, that upon both sides of this controversy there was a great deal of blind error and rash dogmatism, which on the side of the chemists, as in Paracelsus, took the form of quackery and mysticism; while the Galenists, on the other hand, were the supporters of tradition and all its incumbrances, and too often the envenomed partisans of old blunders or misconceptions, as opposed to new forms of truth. But the original idea of those who afterwards became identified with the sect of the Galenists, was rather to free the ancient medicine from the irrational dogmas and methods of cure with which it had been overlaid by the Arabians and the monks, than to insist upon mere antiquity, or upon Galen's anthority in particular, as demanding the blind assent of mankind in opposition to new truth. Now that chemistry has really given us new methods of preparing drugs, which supersede many of those that have been used from time immemorial, it is still customary with some to call preparations by the latter methods *Galenical*, as contrasted with the crystalline alkaloids, or the perfectly pure acids and bases, which contain the virtues of most of our most valuable vegetable medicines. See GALENUS, PARACELSUS, ALCHEMY, and the several articles on the materia medica.

GALE'NUS, CLAUDIUS, commonly called GALEN, a very celebrated physician, b. at Pergamus, in Mysia, 130 A.D. In his 17th year, his father, Nicon, who had hitherto destined him to be a philosopher, in consequence of a dream, chose for him the profession of medicine. This subject he first studied at Pergamus, afterwards at Smyrna, Corinth, and Alexandria. He returned to his native city in his 29th year, and was at once appointed physician to the school of gladiators. In his 34th year, he went to Rome, where he stayed for about four years, and gained such a reputation, that he was offered, but declined, the post of physician to the emperor. He returned to his native country in his 38th year, and had scarcely resumed his ordinary course of life, when he received a summons from the emperors M. Aurelius and L. Verus to attend them in the north-eastern frontier of Italy, whither they had gone to make preparations for a war with the northern tribes. He joined the camp towards the end of the year 169; but a pestilence breaking out, the emperors and their court set off for Rome, whither G. accompanied or followed them. On the return of M. Aurelius to the seat of war, G. obtained permission to be left at Rome, alleging that such was the will of Æsculapius, as revealed to him in a dream. How long G. stayed at Rome on this second occasion is not known, but we ascertain from his works that he attended M. Aurelius and his two sons, Commodus and Sextus, and that at about the end of the 2d c. he was employed to compound a celebrated medicine called theriaca for the emperor Severus. If the statement of one of his Arabic biographers be correct, who expressly says that G. was only twice at Rome, we must infer that the greater part of his middle and more advanced life was spent in that city. The place and date of his death are not known with certainty, but it is believed that he died in Sicily about the year 201.

The works that are still extant under the name of G. consist, according to Choulant, in his *Handbuch der Bücherkunde für die aeltere Medicin*, of 83 treatises acknowledged to be genuine; 19 whose genuineness has been questioned, 45 undoubtedly spurious

19 fragments; and 15 commentaries on different works of Hippocrates. Besides these, he wrote a great number of works whose titles only are preserved, and altogether it is believed that the number of his distinct treatises cannot have been less than 500.

We may divide his works into (1) those on anatomy and physiology; (2) those on dietetics and hygiène; (3) those on pathology; (4) those on diagnosis and semeiology; (5) those on pharmacy and materia medica; (6) those on therapeutics, including surgery; (7) his commentaries on Hippocrates; and (8) his philosophical and miscellaneous works. We have most of these works in Greek, the language in which they were originally written; some are, however, preserved only in Latin translations, and a few only in Arabic. His most important anatomical and physiological works are—*De Anatomicis Administrationibus*, and *De Usu Partium Corporis Humani*. Of the latter, Dr. Greenhill (Smith's *Dictionary of Greek and Roman Biography*) remarks that "it is no less admirable for the deep religious feeling with which it is written, than for the scientific knowledge and acuteness displayed in it." For a good general account of G.'s anatomical and physiological knowledge, we may refer to a memoir published by the late prof. Kidd of Oxford in the sixth volume of *The Transactions of the Provincial Medical and Surgical Association*, entitled "A Cursory Analysis of the Works of Galen, so far as they relate to Anatomy and Physiology," and Daremberg's *Exposition des Connaissances de Galien sur l'Anatomie, la Physiologie, et la Pathologie du Système Nerveux* (Paris, 1841), may also be consulted with advantage. His anatomical and physiological writings are by far the most valuable of his works. They contain undoubted evidence of his familiarity with practical anatomy; but whether he derived his knowledge from dissections of human bodies or those of the lower animals, is uncertain. The latter is the most probable view—(1) because he frequently recommends the dissection of apes, bears, goats, etc.; and (2) because he mentions, as something extraordinary, that those physicians who attended the emperor M. Aurelius in his wars against the Germans, had an opportunity of dissecting the bodies of the barbarians. Much curious information regarding G.'s views on dietetics and hygiène will be fonnd in Adams's *Commentary on the First Book of Paulus Ægineta*. His pathology was very speculative and imperfect. In his diagnosis and prognosis, he laid great stress on the pulse, on which subject he may be considered as the first and greatest authority, for all subsequent writers adopted his system without alteration. He likewise placed great confidence in the doctrine of critical days, which he believed to be influenced by the moon. In materica medica, his authority was not so high as that of Dioscorides. Numerous ingredients, many of which were probably inert, enter into most of his prescriptions. He seems to place a more implicit faith in amulets than in medicine, and he is supposed by Cullen to be the author of the anodyne necklace, which was so long famous in England. We cannot attempt to enter into his system of therapeutics. We may, however, observe, that his practice is based on two fundamental principles—(1) that disease is something contrary to nature, and is to be overcome by that which is contrary to the disease itself; and (2) that nature is to be preserved by that which has relation to nature. Hence arise two general indications of treatment—the one taken from the affection contrary to nature, which affection requires to be overcome; the other from the strength and natural constitution of the body, which requires to be preserved.

Before G.'s time, the medical profession was divided into several sects, who were always disputing with one another; as, for example, the Dogmatici, Empirici, Eclectici, Pneumatici, and Episynthetici. After his time, all these sects seem to have merged in his followers. The subsequent Greek and Roman medical writers were mere compilers from his writings; and as soon as his works were translated (in the 9th c.) into Arabic, they were at once adopted throughout the east, to the exclusion of all others. In short, G. reigned paramount throughout the civilized world till within the last 300 years. The records of the London college of physicians afford a striking illustration of this fact, in so far as England is concerned. In 1559, Dr. Geynes "was cited before the college for impugning the infallibility of Galen. On his acknowledgment of his error and humble recantation, signed with his own hand, he was received into the college."

The Greek text has been published four times. The first edition was the Aldine, printed in 1525, in 5 folio volumes; the latest and most accessible edition is that of C. G. Kühn, in 20 octavo volumes, the publication of which extended from 1821 to 1833. A good critical edition is still required.

GALEOPITH'ECUS. See FLYING LEMUR, *ante*.

GALERITES (*galerus*, a cap), a genus of fossil sea-urchins, peculiar to and abundant in the chalk measures. The generic name, as well as that popularly given to them in the districts where they abound, viz., "sugar-loaves," is descriptive of the elongated and more or less conical shape of their shell. The body in breadth is nearly circular or polygonal. The under surface is entirely flat, and has the mouth placed in its center, with the vent near the margin. There are five avenues of pores reaching from the mouth to the summit. These fossils are often found silicified.

GALE'RIUS, VALERIUS MAXIMIANUS, a Roman emperor of humble parentage, was b. near Sardica, in Dacia, entered the imperial army, and rose from one grade of military rank to another, until Diocletian conferred on him, along with Constantius Chlorus, the title of Cæsar (292 A.D.), and gave him his daughter in marriage. On the abdication of

Diocletian (305 A.D.), he and Constantius became *Augusti*, or joint-rulers of the Roman empire. On the death of Constantius at York (306 A.D.), the troops in Britain and Gaul immediately declared their allegiance to his son, Constantine (afterwards Constantine the great), much to the chagrin of G., who expected the entire sovereignty of Rome to fall into his hands. He died in 311 A.D. G. was a brave soldier and a skillful commander, but appears to possess no other claims to the respect of posterity. He hated the Christians "with a perfect hatred;" and it is believed that it was he who forced Diocletian to issue his famous edict against them, which caused the *last* of the imperial persecutions. His mother, an ignorant pagan fanatic, is said to have exercised much influence over him; but it is highly probable that his treatment of the adherents to the Christian faith was also determined by a politic opposition to Constantius and his son, who tolerated and even respected the new opinions and practices.

GALES, JOSEPH, 1760–1841; b. England. He was a bookseller and the publisher of the *Sheffield Register*. His liberal principles brought him into difficulty with the government, and he sold the paper to the poet James Montgomery, and coming to Philadelphia edited the *Independent Gazette*, and was the first to report debates in congress by short-hand. In 1799, he went to Raleigh, N. C., and established the *Register*, which he edited for nearly 40 years.

GALES, JOSEPH, 1786–1860; b. England; son of Joseph. He came to America with his father, and was educated in the university of North Carolina. He learned the art of printing in Philadelphia, and in 1807 settled in Washington as a partner in the *National Intelligencer*, of which journal he became sole proprietor in 1810. Two years afterwards he took William W. Seaton, his brother-in-law, into partnership, and in 1818 began the daily issue of the paper, which continued until 1869.

GALESBURG, a city of Illinois, U. S., the center of extensive railway communications and a rich agricultural district. It has large foundries and agricultural manufactories, and is the seat of a Universalist university and a Congregational college. In 1872, it had 27 schools, 15 churches, 4 newspapers (one daily), and a monthly periodical. Pop. '70, 10,158.

GALESBURG (*ante*), a city in Knox co., Ill., on the Chicago, Burlington and Quincy line, at the junction of the Peoria railroad, 164 m. w.s.w. of Chicago; pop. '70, 10,158. Situated in the midst of a rich farming region, it has considerable trade; also iron-foundries, and other important manufactories. The principal educational institutions are the Lombard (Universalist) university, founded in 1857, and Knox (Congregational) college, organized in 1841. Both institutions admit women. There are more than 15 churches, a city library, and a young men's association.

GALE'S COMPOUND, powdered glass with gunpowder, rendering the latter non-explosive; so named after the patentee.

GALESVILLE, a t. of Wisconsin, U. S., founded in 1854 by the Hon. George Gale, who endowed it with a Methodist university, which in 1872–73 had 5 professors and 145 students. Pop. '70, 1068.

GALIA'NI, FERDINANDO, an Italian savant, was b. in Chieti, a province of the Abruzzi, in 1728, and exhibited at an early period an extraordinary aptitude for learning. Philosophy, history, archæology, and more especially the science of political economy, were his favorite studies; but, nevertheless, he first attracted notice by a clever squib on the death of the public executioner. This consisted of a collection of essays eulogistic of the deceased, in which the style of the president and leading members of the Neapolitan academy was admirably imitated. His next publication, *Della Moneta*, written when he was barely twenty, evinced his great learning and powers of reflection, and must be regarded as a valuable contribution to the science of political economy. Its leading principle is, that coin is a merchandise, and that its value and interest ought to be left free like other goods. In 1751, he visited the chief cities of Italy, and was everywhere honorably received. Having during his travels acquired an enthusiastic love for naturalistic pursuit, on his return to Naples he collected a rich assortment of the stones and volcanic matter of Vesuvius, which he subsequently presented to the pope, accompanied by a learned thesis. On one of the stone specimens, he engraved the following suggestive inscription, "*Beatissime pater, fac ut lapides isti panes fiant*;" and received, by way of answer, the rich prebend of Amalfi, for which he had previously qualified himself by entering into holy orders. In 1759, he became secretary to the Neapolitan embassy at Paris, where his wit, vivacity, and learning made him a universal favorite. In 1767, he visited England, whose social and political institutions he studied deeply. On his return to Paris, he wrote another treatise on political economy, entitled *Dialoghi sul Commercio del Grano* (Dialogues upon the Trade in Corn), in which he argues against both the extreme protectionists and the pure free-traders. Being recalled to Naples, he was successively appointed to various posts of trust and importance. He died at Naples in 1787, leaving behind him rare collections of musical MSS., ancient coins, sculptures, medals, precious stones, cameos, etc.

GALICIA, a crown land belonging to the Austrian monarchy, including the former kingdoms of Galicia and Lodomeria, the duchies of Auschwitz and Zator, and the grand-duchy of Cracow. Area, 30,200 sq.m.; pop. '69, 5,444,689. With the exception of

114,000 Germans, and near 500,000 Jews, the inhabitants are of the Slavonic race, the western part of G. being occupied mainly by Poles, the east by Ruthenians. In faith the people of G. are mostly Catholics. The country is a high terrace, situated at the northern base of the Carpathians. The northern portion forms an extensive plain, broken only by low ranges of hills. There are many large rivers—those in the w. being feeders of the Vistula, those in the e., of the Danube and Dniester. The climate of G. is colder than that of any other portion of the Austrian empire; the soil, with the exception of some sandy and marshy districts, is fertile, and produces corn, which is exported in considerable quantities. Flax, hemp, tobacco, hops, etc., are likewise cultivated. Horses, cattle, and sheep are raised in considerable numbers. Wolves and bears are still found in the mountainous districts. Salt is the most important mineral. Industry has lately made marked progress. Commerce is on the increase. The roads are good; the railway from Cracow to Lemberg has developed the resources of the country greatly. For administrative purposes, G. has been divided into Lemberg, Cracow, and Stanislawow. G. takes its name from the old fortress and town of Halicz, on the Dniester. The original Slavonic inhabitants, the Ruthenes, were, in the 9th c., conquered by the Russians of Kiew. The western portion of the country had already become dependent on Poland, and afterwards on Hungary. In 1382 it was restored to Poland, and continued to belong to that country till the partition of 1772, when G. became one of the crown-lands of Austria. In 1846, Cracow, with the territory belonging to it, was, by a treaty of the three powers (Austria, Russia, and Prussia), given up to the emperor of Austria, and by him annexed to the crown-land of Galicia.

GALICIA, formerly a province in the n.w. of Spain, with an area of 11,344 sq.m., has been divided, since 1833, into the minor provinces of Coruña, Lugo, Orense, and Pontevedra, whose joint population was, in 1870, 1,989,281. The country is mountainous, being covered by several offsets of the Asturian chain, rising in their highest peaks to the height of about 6,000 feet. Capes Ortegal and Finisterre project into the Atlantic. The numerous rivers form *rias*, or small estuaries at their mouths, and afford secure havens and roads. The principal river is the Minho, which, with its feeders, the Sil and the Avia, is navigable as it approaches the sea. G. is one of the most fruitful portions of Europe, and has a mild nourishing climate. Rich meadows and dense forests occur everywhere, but the soil is more suited to the cultivation of garden produce than of corn. The inhabitants, who are called Gallegos, are a robust, vigorous, and industrious race. They visit various parts of the country, and are employed in Madrid as water-carriers, porters, etc. Fishing and navigation are the occupations most largely followed. Linen manufactures have been recently established. The principal towns are St. Jago di Compostella, and the two strongly fortified seaports Coruña and Ferrol.

GALICZ. See HALICZ.

GALILEE, the name applied to a porch or chapel placed at the entrance to a church, beyond which women were not permitted to pass. In abbeys, for example, the monks came to the galilee to see their female relatives. A portion of the nave was sometimes marked off by a step, or, as at Durham, by a line of blue marble, to mark the boundary to which women were limited. There are fine specimens of galilees at Lincoln, Ely, and Durham.

GALILEE (Heb. *Galil*, a "circle" or "circuit"), a name latterly applied to one of the four Roman divisions of Palestine, originally referred only to a district of the tribe of Naphtali. Here were situated the 20 towns which Solomon gave to Hiram, king of Tyre, for his assistance in building the temple. Phenician colonies, in consequence, appear to have established themselves here, for at a later period we find Isaiah (ix. 1) speaking of the district as "Galilee of the nations." These "nations," or gentiles, finally spread themselves over all the surrounding country, until, in the time of our Lord, the name "Galilee" embraced the whole northern portion of Palestine from the Mediterranean to the Jordan. The district was divided into upper and lower G., the former being hilly but well wooded, and the latter level and very fertile. As early as the time of the Maccabees (book I. chap. v. verses 20–23), the number of Jews in G. was very small; Strabo, a contemporary of Christ, states that in his day it was mainly inhabited by Syrians, Phenicians, and Arabs, to whom Josephus adds Greeks. The principal towns at the dawn of Christianity were Tiberias, Tarichæa, and Sepphoris; those that figure in the gospels are Cana, Capernaum, Nazareth, and Nain. The Jewish inhabitants of G. spoke a broader and coarser dialect than their southern brethren of Judea, and were held in low estimation by the latter, partly on account of their more liberal sentiments in regard to religion. It has been thought likely that this liberality, the existence of which is indisputable, was owing to their intercourse with their different heathen neighbors. Every one of the disciples was a Galilean either by birth or residence, and consequently may not have been a *Jew* at all in the strict sense of the term; i. e., in being able to boast of having "Abraham for his father." The first three gospels are chiefly taken up with records of the Savior's ministrations in this province. After the destruction of Jerusalem, the despised G., as if retributively, became the refuge of the proud doctors of Jewish law, and the city of Tiberias the seat of rabbinical learning. The ruins of many fine synagogues are still extant in the old towns and vil-

lages of this region. At present, G. belongs to the pashalic of Damascus, in the Turkish province of Syria or Soristan, and, as of yore, is remarkable for its beauty and fertility. It still has a considerable number of Jewish inhabitants. For sea of G., see *Gennesaret*.

GALILEE, Sea of. See Gennesaret, *ante*.

GALILEI, Galileo, the creator of experimental science, was born at Pisa on Feb. 15 1564. He belonged to a Florentine family more ancient than opulent. G., by desire of his father, exclusively directed his early studies to medicine, and the prevailing Aristotelian philosophy, the dogmas of which he soon ventured to disbelieve and despise. At the age of 18 he made one of his most important discoveries. Happening on one occasion to observe, in the cathedral of Pisa, the oscillation of a lamp casually set in motion, G. was struck with the apparent measured regularity of its vibrations; and having tested the correctness of this observation by comparing the beat of his own pulse with the action of the pendulum, he concluded that by means of this equality of oscillation a simple pendulum (q.v.) might become an invaluable agent in the exact measurement of time. This discovery he subsequently utilized by the successful application of the pendulum in constructing a clock for astronomical purposes. G.'s irrepressible bias towards mechanical constructions and experimental science received a new impulse from his intercourse with a friend of his father's, Ostilio Riccio, professor of mathematics, who, in compliance with the youth's entreaties, initiated him into the principles of mathematics. Such was G.'s absorption and delight in his new studies, that his father at length sanctioned his abandonment of the art of medicine, in order that he might concentrate his powers on his chosen sciences. The first fruit of his geometrical investigations was the invention of a hydrostatic balance, by which the specific gravity of solid bodies might be ascertained with the nicest accuracy. In 1589, the fame of G.'s extraordinary learning having reached the grand duke of Tuscany, this enlightened prince appointed him professor of mathematics in the university of Pisa, where he covertly inculcated many of those great innovations in physical science which have since added such luster to his memory. About this period he turned his attention to the then very imperfectly comprehended laws of bodies in motion; and in opposition to all received systems, he propounded the novel theorem, that all falling bodies, great or small, descend with equal velocity. This soon led him to the discovery of "the *three* laws of motion," and the law regulating the motion of falling bodies, which is expressed by the formula $S = \frac{1}{2} ft^2$. This theory of falling bodies was proved correct by several experiments which were made from the summit of the leaning tower of Pisa, greatly to the chagrin of the Aristotelians, whose enmity to G. now grew more decided. In consequence, he deemed it prudent to relinquish his chair at Pisa, and retired to Padua, where he accepted the offer of the Venetian senate to lecture on mathematics in the university for the space of six years. It is also said, however, that G. lost his chair at Pisa, from having ridiculed the mechanical pretensions of John de' Medici, son of Cosmo I. G.'s engagement at Padua was eventually prolonged to the term of 18 years; but so urgent was his desire to return to his birthplace, that he sought a restoration to his former post at Pisa, and was gratified by an assent being eagerly accorded by Cosmo de' Medici, with exemption from any but a voluntary exercise of the duties of the professorship. During his sojourn at Padua, his course of lectures enjoyed extraordinary popularity; crowds of pupils flocked to hear him from all parts of Europe; and he was the first to adapt the Italian idiom to philosophical instruction. Among the various and noble discoveries with which he enriched science, may be noticed a species of thermometer, a proportional compass or sector, and, more important than all, the construction of the refracting telescope for astronomical investigation. In 1609, he offered his first complete telescope to the doge of Venice, Leonardi Deodati, by whom it was tested from the tower of St. Mark with equal surprise and delight. In the same year he constructed a microscope; and then this indefatigable interpreter of the mysteries of nature commenced his astronomical researches by means of his own telescope. He speedily concluded that the moon, instead of being a self-luminous and perfectly smooth sphere, owed her illumination to reflection, and presented an unequal surface, deeply furrowed by valleys and mountains of great extent. The milky way he pronounced a track of countless separate stars; and these discoveries were crowned by a still more important series of observations, which led to the discovery of the four satellites of Jupiter on the night of Jan. 7. 1610 (though it was not till the 13th of the same month that he came to the conclusion that they were satellites, and not fixed stars), which he named the Medicean stars, in honor of his constant protectors in that family. He also was the first to note movable spots on the disk of the sun, from which he inferred the rotation of that orb. Encircled by the luster of these sublime discoveries, he departed from Padua, and returned to Tuscany in 1610, where renewed quarrels with the Aristotelians disquieted and embittered his existence. In 1611, he visited Rome, and was received with great distinction, being enrolled a member of the Lincei academy; but four years later, on repeating the visit, his reception was widely different, as by that time in his work on the solar spots he had openly advocated the Copernican system, and was in consequence denounced as a propounder of heretical views. He repaired again to Rome, to demand an experimental inquiry into the soundness of

his views; but the grand duke apprehending inquisitorial dangers for his favorite, summoned him back to Tuscany; at the same time the pope, through the famous cardinal Bellarmine (a sincere friend of G.'s), commanded him to abstain from all future advocacy of his heretical doctrines. Some time after, he wrote his most famous work in the form of a dialogue between three fictitious interlocutors, the one in favor of the Copernican system, the second an advocate ot the Ptolemaic, and the third a rabid supporter of the Aristotelian school. Of course, the whole weight of the *proof* falls into the Copernican scale; and nothing can exceed the classic beauty of this composition, or the compactness of the chain of its argument. In 1630, G. contrived to obtain the papal imprimatur, which was subsequently revoked; but having got a similar authorization at Florence, he published, in 1632, this exponent of his opinions under the title of *Un Dialogo intorno i due Massimi Sistemi del Mondo.* Hardly had the work been issued, when it was given over to the jurisdiction of the inquisition. Pope Urban, previously cardinal Barberini, and, until now, a friend and eulogist of G., was led to believe that G. had satirized him in this work under the title of *Simplicio*, as one who is careless about scientific truth, and who timidly adheres to the saws of antiquity. He resolved to punish the audacious philosopher. In spite of his 70 years and heavy infirmities, G. was summoned before the inquisition to answer for his heresies. After a wearisome trial and incarceration, his judges condemned G. to abjure by oath on his knees the sublime truths of his scientific creed. This he was weak enough to do. His latest biographer, M. Philarète Chasles, however, denies that G. was put to the torture, and pronounces the letter of G. to Reinecci, from which Tiraboschi quotes to prove it, a forgery. His famous whisper, *E pur si muove* ("But nevertheless it does move"), is also in danger of being regarded as a fiction. G. was sentenced to an indefinite term of imprisonment in the inquisition, which was soon commuted by pope Urban, at the request of Ferdinand the grand, duke of Tuscany, into permission to reside at Siena, and finally at Florence, should the prisoner's health require the change. In his retreat at Arcetri, he continued with unflagging ardor his learned researches, even when hearing grew enfeebled and sight was extinguished. He died on Jan. 8, 1642, at the age of 78, and was interred by ducal orders in the cathedral of Santa Croce, where a majestic monument symbolizes his great achievements. His disposition was truly genial; he enjoyed with keenness the social wit and banter of his chosen friends, and the generous pleasures of the banquet; and the readiness with which he offered or accepted atonement, modified a somewhat irascible disposition. The great deficiencies in his character were a want of tact to keep out of difficulties, and a want of moral courage to defend himself when involved in them. His biting satirical turn, more than his physical discoveries, was the cause of his misfortunes. The dignitaries of the church who persecuted G., warned him beforehand in the friendliest way to be "more prudent." Their conduct in persecuting opinion, or rather, in G.'s case, *demonstrated fact*, is of course utterly inexcusable; but there is no reason why we should run to the other extreme, and declare G. to be a martyr. No great man had ever less claim to the title. It is also right to add, that the congregation of the inquisition by which G. was condemned, is not believed by Roman Catholics to speak with the plenary authority of the Catholic church, nor are its decisions regarded as infallible even by the most extreme ultramontanes. G. was of small stature, but of a robust and healthy frame; his countenance was attractive, and his conversation cheerful. He loved art, and cultivated especially music and poetry. Ariosto he knew almost by heart, and appreciated keenly the beauties of this great classic. Tasso, on the other hand, he unduly depreciated, and inflicted much pain on the sensitive spirit of the poet by his severe criticism entitled *Considerazioni al Tasso.* His own style is nervous, flowing, and elegant. The best edition of G.'s collected works is that by Alberi (6 vols., Flor. 1842–56). See Viviani's Life of G.; Brewster's sketch; M. Chasles's *Galileo Galilei* (1862); Pieralisi's *Urbano VIII. e G.* (1875); Gebler's *G. und die Römische Curie* (1876); Berti's *Copernico e il vicende del Sistema Copernicano* and *Il Processo Originale di G.* (Rome, 1876); the *Quarterly Review* for April, 1878; and Riccardi's *Bibliographia Galileiana* (1873). We may briefly recapitulate G.'s most important contributions to physical science under the following heads: 1. The relation between space and time in the case of falling bodies, also the "three laws of motion:" 2. The path of projectiles is a parabola; 3. The isochronism of the pendulum; 4. That air has weight, also partial discovery that suction is owing to the pressure of the atmosphere; 5. The re-invention of Aristotle's theory respecting sound; 6. The invention of the telescope; 7. The discovery of the satellites of Jupiter, phases of Venus, and spots on the sun. For the nature of these discoveries, see PENDULUM, FALLING BODIES, PROJECTILES, etc.

GALINGALE, a name often applied to the tubers of *cyperus longus*, and sometimes to the whole plant. See CYPERUS.

GA'LION, a city in Crawford co., Ohio, on the Atlantic and Great Western railroad, at the junction of two other lines; 58 m. n.e. of Columbus; pop. about 6,000. It has railroad shops, a foundry, and other manufactures, schools, churches, banks, etc.

GALIPEA. See ANGOSTURA BARK.

GALIUM. See BEDSTRAW.

GALL. A synonym for bile, the secretion of the liver (q.v.).

GALL, Franz Joseph, the founder of phrenology, was b. at Tiefenbrunn, near Pforzheim, on the borders of Baden and Würtemberg, Mar. 9, 1758. He studied medicine at Vienna, and settling there, became known as a practical physician, and by the publication of his *Philosophisch-Medicinische Untersuchungen über Natur und Kunst im gesunden und kranken Zustande des Menschen* (Vienna, 1791). But he acquired a much more extended reputation by his lectures on the structure and functions of the brain, which he began to deliver in 1796. See PHRENOLOGY. His views were so subversive of received doctrines on the subject of mind, that a spirit of opposition was excited, and the lectures were prohibited in 1802 by the Austrian government. Along with his pupil Dr. Spurzheim (q.v.), who became his associate in 1804, G. quitted Vienna in 1805, and during his travels through Germany, Holland, Sweden, and Switzerland, expounded his views in many of the universities and principal cities, where he found many adherents as well as opponents. In 1807, he settled as a physician in Paris, and there began lecturing and writing for the propagation of his opinions. As a foreigner teaching science to the French, he was discountenanced by Napoleon. On Mar. 14, 1808, he and Spurzheim presented to the institute of France a memoir of their discoveries, on which a committee of the members of that body (including Pinel, Portal, and Cuvier) drew up an unfavorable *Report*. Of this there is a translation in the *Edinburgh Medical and Surgical Journal* for Jan., 1809. G. and Spurzheim thereupon published their *Memoir*, with a reply to the *Report* in a volume entitled *Recherches sur le Système Nerveux en général, et sur celui du Cerveau en particulier; suivi d'Observations sur le Rapport*, etc. (Paris, 1809, 4to). This was followed by their larger work, *Anatomie et Physiologie du Système Nerveux*, etc. (Paris, 1810–19, 4 vols. 4to), with an atlas of 100 plates; but the two phrenologists having parted in 1813, the name of G. alone is prefixed to vols. 3 and 4; and it alone is borne by a reprint of the physiological portion of the work, entitled *Sur les Fonctions du Cerveau, et sur celles de chacune de ses Parties* (Paris, 1825, 6 vols. 8vo). Of the contents of that edition, there is a summary in the *Phrenological Journal*, x. 459. A German translation of it, entitled *Vollständige Geisteskunde*, etc., appeared at Nuremberg in 1833; and an indifferent English version by Dr. Winslow Lewis, junior, at Boston, U. S., in 1835 (6 vols. 12 mo). A translation of the chapters *On the Functions of the Cerebellum* is included in a volume with that title, published by G. Combe (Edin. 1838, 8vo). In answer to accusations of materialism and fatalism brought against his system, G. had early published a part of the work under the title of *Des Dispositions innées de l'Ame et de l'Esprit*, etc. (Paris, 1812). He continued to practice medicine and pursue his researches at Montrouge, near Paris, till his death, Aug. 22, 1828. A catalogue of his collection of skulls, etc., is printed in the *Phrenological Journal*, vols. vi. and vii. As a thinker, he was original and independent; as an observer, industrious and persevering; as a writer and lecturer, forcible and clear, Even those who reject his system as insufficiently borne out by facts, allow that he has conferred signal service on science by his discoveries in the anatomy and physiology of the brain, and that by stirring to the bottom many questions regarding mind, and the organic conditions by which its phenomena are affected, he has contributed to deepen the foundations of psychology, and to render it applicable to human affairs. It is long since the apprehension of danger to religion and morality from his doctrines died away among the intelligent and well informed. In Great Britain, phrenology became known less through G.'s writings than through those of Spurzheim, who came over to England in 1814. So early, however, as 1803, it had been criticised in the *Edinburgh Review*, ii. 147. See further, *Transactions of the Phrenological Society*, p. 1 (Edin. 1824); *Phrenological Journal*, vols. 5, 8, 9, 11, 15, 16, 17, and 19; a *Historical Notice of the Discovery of the Anatomy of the Brain*, appended to G. Combe's *Phrenology Applied to Painting and Sculpture*, p. 151 (Lond. 1855); prof. Laycock on *Mind and Brain*, ii. 164, 168 (Edin. 1860).

GALL, St., one of the most important manufacturing towns of Switzerland, capital of the canton of the same name, is pleasantly situated on the left bank of the Steinach, at an elevation of 2,061 ft. above sea-level, and is distant 40 m. from Zürich in a straight line e.n.e. It is a well-built town, surrounded by old walls; but the ditch has been filled up and converted into garden-grounds. Among the principal buildings are the abbey church, which was completely modernized in the course of last century; the monastery, portions of which are now occupied by public government offices, and by the convent library, containing 1506 MSS., and among them several of the classics, that were at one time thought to have been lost. See GALL, ST., ABBEY OF. The greatest building is the schoolhouse, which contains a natural history museum and the town library. The manufactures of St. G. consist chiefly of cotton goods, particularly of *Swiss muslins*. It has also linen manufactures, carries on bleaching and embroidery extensively, and is the great mart for the produce of Appenzell and Thurgau. Pop. '70, 16,675.

GALL, St. (Ger. *St. Gallen*), **ABBEY OF**, a celebrated Swiss Benedictine monastery, which gives its name to the canton in which it is situated. It was founded early in the 7th c. by St. Gall, or Gallus, an Irish monk, a disciple of Columbanus, and one of that distinguished band, who in that age, from the various monasteries of Ireland and the kindred establishment of Iona, carried the elements of learning and civilization over a large portion of the continent of Europe. Gallus had accompanied Columbanus to

Anegray and Luxeuil, and ultimately himself, in company with a few followers, repaired to Switzerland, where, in a hermitage on the banks of the Steinach, he acquired such fame for sanctity by his teaching and example, that on his death, there arose, in honor of his memory, what, in progress of time, became one of the most celebrated of the many magnificent establishments of the Benedictine order. The succession of abbots from the days of Gallus is carefully chronicled, and the share which each of them had in the erection and enlargement of the monastic buildings. It will be enough to say that, through the piety and munificence of the faithful, the abbey of St. G. gradually became one of the masterpieces of mediæval architecture; and that the genius and skill which were lavished on its construction, and on the decoration of its halls and cloisters, had a large share in developing the Christian art of the period. The monks of St. G., too, may be reckoned among the best friends and preservers of ancient literature. They were indefatigable in the collection and transcription of MSS.—biblical, patristic, sacred and profane history, classical, liturgical, and legendary. Some of the MSS. which are still shown in the library are monuments of the skill and industry of the copyists; and several of the classics, especially Quintilian, Silius Italicus, and Ammianus Marcellinus, have been preserved solely through the MSS. of St. Gall. For a time, the abbey was subject to the bishop of Constance, and an animated dispute was for a long time maintained between that prelate and the monks as to the right of electing the abbot. It ended, however, in the recognition of the right of free election; and ultimately, from the growth of the monastic possessions, and the important position which the abbot held, the monastic domain, which comprised a great part of northern Switzerland, became a distinct jurisdiction, within which the abbot, like many of his brethren in the great Benedictine monasteries, exercised all the rights of a suzerain. For several centuries, the abbey of St. G. held one of the highest places in the order. Its schools enjoyed wide reputation. Its members held a distinguished place among the scholars of mediæval Germany; and many of them, as, for example, Notker, are known to have cultivated not only the ordinary learning of the schools, but also physic, mathematics, and astronomy. The school of St. G., too, was one of the most eminent for the cultivation of music, and its MSS., preserved in its library, have been extensively made use of by the restorers of ancient ecclesiastical music. A town of considerable importance grew up around the monastery, and was called by the same name; and as the wealth and influence which attached to the dignity of the abbot began to make it an object of ambition to the rich and powerful families, we find the succession of abbots, in the 13th and 14th centuries, sadly degenerated from their pious and learned predecessors in the office. A stringent reform was enforced about the time of the council of Constance; but the burghers of St. G. had grown dissatisfied under this rule; and on the outbreak of the reformation in 1525, they threw off their subjection, and embraced the new doctrines. At the close, however, of the religious war in 1532, the Catholic religion was re-established, and the abbot reinstated, though with diminished authority, in his ancient dignity. At the French revolution, the abbey of St. G. was secularized (1798), and its revenues were soon afterwards sequestrated (1805). By a later ecclesiastical arrangement, the abbacy of St. G. was raised to the dignity of a bishopric, which, in 1823, was united to that of Chur. They were afterwards, however, separated; and in 1847, St. Gallen was erected into a bishopric, with a distinct jurisdiction.

GALL, St., Canton of, a Swiss canton, bounded on the n. by Thurgau and the lake of Constance, e. by the Vorarlberg, s. by the Grisons and Glarus, and w. by Zürich and Schwytz. The country is for the most part mountainous; the general slope of the surface being towards the n and n.w. Several of the summits attain a height of 6,000 or 7,000 ft., one (the Gallanda) a height of 8,800, and one (Schirbe) that of 9,000. The Rhine touches the canton of St. G. near Pfeffers, and for about 50 m. forms its eastern boundary. The chief rivers that intersect the canton are the Seez, the Tamina, and the Thur. Portions of the lakes of Constance, Zürich, and Wallenstadt, lie within its boundaries. The chief produce of the canton consists of fruit, especially apples and cherries, wine, *kirschwasser*, corn, maize, and potatoes. The amount of corn produced is but trifling, and a considerable part of the land is devoted to pasture. Iron is found in considerable abundance, and of good quality, at Gunzenberg; and coal, as also peat, is raised within the canton. The manufactures are of linen, muslin, cotton, lace, embroidery, and glass; and wax-bleaching and tanning are also extensively carried on. The linen trade is of very old standing. Its seat is the town of St. Gall, which was celebrated for its linens as early as the 13th c., but it has in later times been almost entirely replaced by the manufacture of cotton.

The erection of St. G. into a distinct canton is comparatively of recent date. It was formed upon the secularization of the domain of the abbot by the union of the abbey territory with several districts previously subject to the older cantons—viz., the Rheinthal, Sargans, Werdenberg, Sax, Gaster, Utznach, together with the town of Rapperschwyl; so that the new canton of St. G. actually incloses upon all sides the canton of Appenzell, which forms, as it were, an island within the new district. The language is a Suabian dialect of German. The canton of St. G. sends eight members to the national council. Its government is one of the most democratic in Switzerland. It consists of a great council, the members of which are chosen for two years by the votes

of all citizens above 21 years; and who appoint from among themselves, for four years, an executive, called the lesser council, consisting of seven members. The local prefects and other district officers are elected annually in their several districts. The area of the canton is 772 sq. miles. Pop. '77, 197,872, of whom about 120,000 were Catholics, and the rest chiefly Calvinists. Chief town, St. Gall (q.v.).

GALLAGHER, WILLIAM D., b. Philadelphia, 1808. In 1816, he went to Cincinnati to work on a newspaper in the capacity of printer, writing occasional articles. He was successively editor of *The Backwoodsman*, the *Cincinnati Mirror*, the *Western Literary and Monthly Review*, and the *Hesperian*, and assistant editor of the *Cincinnati Gazette*. He has published several volumes of poems, and *Selections from the Poetical Literature of the West;* also works on agriculture. In 1853, he was one of the editors of the Louisville *Courier*. During the war of the rebellion, he was in the employ of the treasury department.

GALLAIT, LOUIS, b. 1810; a Belgian historical painter who studied at Antwerp and Paris, first exhibited at Brussels, and produced, in 1833, his picture of "Tasso in his Cell visited by Montaigne," which established his reputation. His pictures, which are generally on a large scale, represent subjects from the history of the Low Countries. "The Last Moments of Egmont," painted in 1853, "The Abdication of Charles V.," and "The Last Honors paid to Egmont and Horn," were among the chief attractions in the foreign gallery of the international exhibition of 1862. This artist, who resided at Brussels, was entertained in July, 1862, at a public dinner given to him by the amateurs and artists of Great Britain. He is a member of the academy royal of Belgium; obtained a medal in France in 1835, and the decoration in June, 1841; and was elected foreign associate of the Paris academy of fine arts, filling the position rendered vacant by the death of the German painter Overbeck.

GALLAND, ANTOINE, a French orientalist and numismatist, was b. in 1646, at Rollot, near Montdidier, in Picardy. In 1670, he accompanied the French ambassador, Nointel, to Constantinople, when he visited Jerusalem and other places. He returned to France in 1675, but subsequently made two voyages to the east. Colbert and Louvois interested themselves on his behalf, and procured him the means of devoting himself to study. In 1701, he was made a member of the académie des inscriptions, and in 1709, professor of Arabic in the collége de France. He died Feb. 17, 1715. The greatest part of G.'s writings relate to numismatics and the east, but the thing which has secured him the most imperishable reputation, is his translation of the *Arabian Nights* in 12 vols. (*Mille et Une Nuits, Contes Arabes*, Paris, 1704–17). This was the first translation of these grotesque and gorgeous stories ever made into any language of Christendom, and for a good while G. got the credit of being himself the author as well as the translator. Among his other writings, we may mention *Paroles remarquables, bons Mots, et Maximes des Orientaux* (Paris, 1694), and *Les Contes et Fables Indiennes de Bidpaï et de Lokman* (2 vols., Paris, 1724).

GALLA OX, or SANGA, a remarkable species or variety of ox inhabiting Abyssinia. The chief peculiarity is the extraordinary size of the horns, which rise from the forehead with an outward, and then an inward curve, producing a very perfect figure of a lyre, and finally curve a little outwards at the tip, to which they taper gradually. In a specimen presented by Mr. Salt to the museum of the college of surgeons in London, the length of each horn measured round the outer side is 3 ft. 10¼ in., the circumference of each at the base is 1 ft. 3 in., the distance between the tips 3 ft. 4 in. A space of about 3 or 4 in. between the horns is occupied by a tuft of hair. Bruce represents the enormous growth of the horns as a kind of disease or monstrosity, accompanied with emaciation of the animal. Salt controverts this account, but figures the animal so as rather to confirm it. The G. O., however, differs from the common ox in having a hump on the shoulders, in the abrupt descent of the back towards the tail, in the greater length of the legs, and in the narrower space between the horns.

GALLARA'TE, a market t. of n. Italy, in the province of Milan, and 24 m. n. w. of the city of Milan. It is situated on the eastern side of the Somma hills, at the commencement of the fertile region that extends to Milan, with which place it is connected by railway. It is well built, and surrounded by ancient walls; has extensive steam cotton-mills, and an active trade in agricultural produce. Pop. '72, 6,035.

GALLAS ("invaders"), a race inhabiting the s. and e. of Abyssinia. The general name by which the tribes designate themselves is *Oroma* (*orma*, men). Although generally belonging to the negro race, they are not purely negroes, but form with the Fulahs, Mandingoes, and Nubas, as it were, the transition to the Semitic variety, and seem to belong to that great family inhabiting the e. of Africa, from the frontiers of the Cape land to Abyssinia, and usually denominated the Kaffers. They are a vigorous, well-formed people, of a dark-brown color, with hair frizzled, but not quite woolly, round faces, and small sharp eyes, and are distinguished not less by their energy and warlike spirit, than by their mental capacities. They first appear in history in the 16th c., as a barbarous people, extending their conquests from the interior of Africa, laying waste by constant incursions, the countries of eastern Africa, to the mountains of Abyssinia, gradually subduing or expelling the original inhabitants (hence their

name), occupying great part of Abyssinia, and advancing as far as the Red Sea and the gulf of Aden. It is only of late years that their power in Abyssinia, and their incursions into that country, have been partially checked, chiefly by the vigorous government of the king of Shoa, who subdued some of the G. tribes, and induced them to profess such Christianity as exists in Abyssinia. They still, however, occupy many districts of Abyssinia, and extend their power to an indefinite extent over the countries situated s. and s.w. of it. Politically, the G. do not form a single nation, but are divided into numerous tribes, forming separate kingdoms and states, which are frequently at war with each other. Most of the G. follow pastoral avocations. Some, however, through intercourse with the semi-Christian, semi-civilized Abyssinians, have become tillers of the soil. The wandering G. are mainly engaged in hunting and the slave-trade. The larger number of the G. are still heathens, though Mohammedanism has lately made great progress among them. Their religion bears a resemblance to that of the Kaffers.—Compare Jomard, *Notices sur les Gallas* (Paris, 1839); Beke, *On the Origin of the Gallas* (London, 1848).

GALLAS, MATTHIAS VON, Count, 1589–1647; a German soldier distinguished in the thirty years' war; became maj.gen in 1626. In 1629, he was associated with Altruger in the capture and pillage of the city of Mantua, and G. was created field-marshal and ennobled. He succeeded Wallenstein as commander-in-chief, 1645, and after the assassination of Wallenstein, he commanded with Piccolomini in the battle of Nordlingen.

GALLATIN, a co. in s.e. Illinois, on the Wabash and Ohio rivers, traversed by the Ohio and Mississippi, and the St. Louis and South-eastern railroads; 350 sq.m.; pop. '70, 11,134. It is nearly level, and for the most part covered with forests. Corn, wheat, and pork are the staple products. Co. seat, Shawneetown.

GALLATIN, a co. in n. Kentucky, on the Ohio river, intersected by the Louisville, Cincinnati and Lexington railroad; 150 sq.m.; pop. '70, 5,074—600 colored. The surface is hilly, with fertile soil, producing corn, wheat, pork, etc. Co. seat, Warsaw.

GALLATIN, a co. in s. Montana, on the border of Wyoming, intersected by the Yellowstone river and the Gallatin Fork of the Missouri; 6,800 sq.m.; pop. '70, 1578. It is mountainous, with fertile soil in the valleys. Agriculture is flourishing, but timber is not plentiful. Gold and coal are among the minerals. Co. seat, Bozeman.

GALLATIN, ABRAHAM ALBERT ALPHONSE, financier and statesman, was b. at Geneva in 1761. His parents died while he was young, but nevertheless he received a good education at the university of Geneva, where he graduated in 1779. In 1780, he went to the United States, then struggling for independence, and eagerly embraced their cause. He offered his services to capt. John Allen, and so distinguished himself, that he was speedily appointed commandant of Passamaquoddy fort. When peace was restored in 1783, he became teacher of French in Harvard college, but receiving his paternal inheritance soon after, purchased land, first in Virginia, and then in Pennsylvania, where he occupied himself with agricultural pursuits. He entered political life again in 1789, when he was appointed a member of the convention for revising the state constitution of Pennsylvania. In 1793, he was elected a member of the senate of the United States, and in 1795, entered congress. In 1801, Jefferson appointed him secretary of the treasury, in which post he was of signal service to his adopted country, and showed himself to be an exceedingly able financier. In 1809, he became minister of finance. He took an important part in the negotiations for peace with England in 1814, and signed the treaty of Ghent. From 1815 to 1823, he was United States minister at Paris, and in 1826 he was sent to London as ambassador extraordinary. On his return in 1827, he settled at New York, and devoted himself to literature, being chiefly occupied in historical and ethnological researches. From 1831 to 1839, he was president of the national bank; and from 1843 to his death, he was president of the New York historical society. He was one of the founders and the first president of the ethnological society of America. He died Aug. 12, 1849. He was the author of numerous publications on finance, politics, and ethnology. Among these are—*Memoir of the North-eastern Boundary* (1843); *Notes on the Semi-civilized Nations of Mexico, Yucatan, and Central America* (1845), etc.

GALLATIN, MOUNT, in the national park in n.w. Wyoming, about 10,000 ft. high. Along its base runs the Gallatin river, and a branch of Madison river.

GALLAUDET, EDWARD MINER, LL.D., b. Conn., 1837; son of Thomas Hopkins. He has interested himself greatly in promoting the instruction of the deaf and dumb, and in 1864 took measures to establish the national deaf-mute college in Washington, of which he afterwards became president. He has written several books upon the education of the deaf and dumb.

GALLAUDET, THOMAS, D.D., b. Conn., 1822; son of Thomas Hopkins; graduated from Yale college in 1842, and was for 15 years professor in the New York institution for the deaf and dumb. In 1850, he became rector of a Protestant Episcopal church in New York, and established in it a service in the sign language. He has been manager of the church mission to deaf mutes, pastor of the sisterhood of the Good Shepherd, and chaplain of the midnight mission, and has written and labored much in the cause of the education of deaf mutes.

GALLAUDET, Thomas Hopkins, ll.d., 1787–1851; founder of the first institution in America for the education of the deaf and dumb. He was educated at Yale, studied theology at Andover, and was licensed to preach in 1814. His after life was devoted to the instruction of deaf mutes, until 1838, when he became chaplain to the Connecticut retreat for the insane, where he remained until his death. Among his publications are *Discourses; Bible Studies for the Young;* etc.

GALL-BLADDER. See Liver.

GALLE, Johann Gottfried, b. 1812; a German astronomer, educated at Wittemberg; teacher and assistant observer in the Berlin observatory while Encke was director. Having discovered three new comets, he received the prize of the French academy. He was asked by Leverrier to assist in the search for the planet now known as Neptune, and had the good fortune to detect its presence the very evening of the day on which he had received Leverrier's request to search for it. Upon this the French academy awarded Galle another prize. He has published many scientific papers, and a work on climatology.

GALLE, or Point de Galle, a t. and port in s.w. Ceylon, 72 m. s. of Colombo; pop. '71, 47,059. The fort is a mile in circumference, and commands the entire harbor, but is in its turn commanded by a range of hills. A charming feature of the place is the number and variety of trees in and around the settlement, among them palms, cocoa, and bread-fruit. The harbor is spacious and safe except during monsoons. There is a large trade in cocoa-nut oil, cinnamon, plumbago, and coir. Sir J. E. Tennant is of the opinion that this place was the Tarshish of Solomon. In modern times it had no importance until the arrival of the Portuguese. The English took possession of the whole island in 1796.

GALLE'GO, one of the principal affluents of the Ebro, rises at the southern base of the Pyrenees in the province of Huesca, flows s., and after a course of about 90 m., joins the Ebro a mile below Zaragoza.

GAL'LEON (augmentative of *galley*), a name formerly applied to ships-of-war of three or four gun-decks, but subsequently transferred to the large merchant-vessels which every year brought to Spain the gold, silver, and other wealth contributed by its Mexican and South American colonies. They were armed, but being heavy unmanageable vessels, and of immense value, were eagerly sought after as prizes whenever a war broke out.

GALLERY, in a *military* sense, is a covered passage, cut through the earth or masonry in a fortification, either as a means of communication, or as a position whence a musketry-fire can be maintained through loopholes. For the latter purpose, galleries are formed occasionally in the counterscarps of dry ditches, where their defenders exercise a flanking fire upon the ditch. With regard to listening galleries, see Mines, Military.

In a *naval* signification, a G. is a sort of balcony projecting from the stern and stern-quarters of large ships. As an adjunct to the principal cabins, galleries form an agreeable resort during fine weather. Under the article Davit, the G. of a man-of-war is shown.

GALLERY, a word with several applications in architecture. A long passage or corridor is called a gallery. A long room, such as is frequently used for exhibiting pictures—a raised floor in any apartment, supported on pillars—a long passage in the thickness of the wall, or supported on cantalivers (as the whispering G. of St. Paul's): all these are called galleries, They were of very frequent use in the buildings of the middle ages. The rood-loft (q.v.) is a G. running across a church at the entrance to the choir, and supporting a large cross. Organ galleries are also frequent, either in the position of the rood-loft, or at one end of the nave or transept, or corbeled out from the side-wall.

In old baronial halls, the end next the door was usually screened off for the domestics, and above the screen was almost invariably a G. for musicians.

In the older German and French churches, the side-aisles were divided into two stories—the upper forming a G. said to be for the exclusive use of the women.

The arrangement of galleries in tiers one over the other. now so much used in churches, theaters, etc., is entirely modern, dating from the 17th century.

GALLEY, a long, low-built, narrow ship with one deck, much used in the Mediterranean prior to the introduction of steam, and still extant there. Galleys are propelled by sails and numerous oars, the latter being usually worked by convicts or galley-slaves, who are chained to them. The largest vessels of this class were those of the Venetians, some reaching a length of 162 ft., and carrying 12 guns: of these, *half-galleys* and *quarter-galleys* were diminutives. From their small elevation above the sea and swift movement, they were formidable enemies, even to much larger vessels, when smooth water gave play to their evolutions. During the great French war, numberless galleys, fitted as gun-boats, were ready to issue from the Mediterranean ports of Spain and France whenever a British ship was becalmed or disabled near the shore. The celebrated Algerine corsairs committed most of their piracies in swift galleys, which were commonly rowed by the forced labor of Christian slaves. *The galleys* long formed the severest form of punishment in France short of death, and were abolished in 1748.

On board an English ship, the *galley* is the place where the cooking is carried on for the whole ship's company.

Galley is likewise applied to the captain's boat of a ship-of-war, which is usually propelled by six alternate oars.

GALLEY HALFPENCE. These were coins of Genoa, brought into England by the galley-men, or men that came up in the galleys with wine or merchandise, and thence called galley halfpence. They were broader than the English halfpenny, but not so thick, and probably base metal, because by 11 Hen. IV. c. 5, and 13 Hen. IV. c. 6, G. H. were prohibited as a legal tender. The galleys unloaded at the e. end of Lower Thames street, thence called Galley quay, where, in the 17th c., were struck tradesmen's tokens, thereof called Galley quay halfpence (Timbs).

GALLEY-SLAVE. See BAGNES.

GALL-FLY, *Cynips*, a Linnæan genus of insects, now forming the family *gallicolæ* (Lat. gall-inhabiting) of entomologists, and belonging to the order *hymenoptera* (q.v.), section *terebrantia* (Lat. boring), which section is characterized by the females being furnished with an *ovipositor*. Gall-flies are nearly allied to ichneumons, but principally differ from them in depositing their eggs not in the bodies of the larvæ of other insects, nor in their nests, but in plants, on the juices of which their larvæ are nourished. The ovipositor of the female is long, slender, in part spirally rolled up when not in use, and lodged in a groove on the under-side of the abdomen, near the origin of which it is attached; it has at its extremity lateral teeth forming a kind of saw. By means of this organ, the insect makes a minute puncture where she is to deposit her egg, which is sometimes in a leaf, and then generally in one of the ribs of the leaf, sometimes in a young shoot or twig, sometimes in a bud, or in some other part of a plant, not excepting the roots; each species of gall-fly choosing some particular plant, and some particular part of the plant, to which it confines its attacks. An irritant fluid is supposed to be lodged in the puncture along with the minute egg, as a tumor immediately begins to form, becoming an excrescence known as a *gall*. The egg itself increases in size before it is hatched; the gall very rapidly attains its full dimensions; and within it the larva of the gall-fly feeds on the juices of the plant in their most concentrated form; for galls are found to contain the peculiar principles of the plants on which they grow in greater abundance than the adjoining or other parts. It is not until the larva has undergone its transformations, first into the *pupa*, and then into the perfect insect, that it eats its way out of the gall in which it has previously existed. See GALLS.

GALLIA, a co. in s.e. Ohio, on the Ohio river, drained by Raccoon, Campaign, and Symmes creeks, and intersected by the Dayton and Southeastern railroad; 440 sq.m.; pop. '70, 25,545. It is hilly, and to a large extent covered with forests. The soil is fertile, producing corn, wheat, oats, etc. Co. seat, Gallipolis.

GALLIARD (from the French *gaillard*, and that again from *gai*, sprightly) is the name of a lively dance, the same, according to Brossard, as the *Romanesca*, a favorite dance with the Italians. The air is mostly in $\frac{3}{4}$ or $\frac{3}{2}$ time, but sometimes also in $\frac{2}{4}$ or $\frac{4}{4}$ time. The tempo is also quick and lively, with a flowing melody. A writer in *Notes and Queries* (vol. vii. pp. 216, 217) says that he knows at least a hundred different galliard tunes, which are distinguished by different names, probably to indicate with whom they were favorites, such as *The King of Denmark's Galliard; The Earl of Essex's Galliard;* etc.

GALLIA'TE, a t. of n. Italy, in the province of Novara, 4 m. e.n.e. from Novara. It is rather a mean and dirty town, with an old castle and an old church. There are silk-mills here, and cotton-stuffs are also manufactured. G. has an annual fair, which lasts three days. Pop. '72, about 7,018.

GALLIC ACID ($C_{14}H_6O_{10}.2HO$) occurs in the form of colorless silky needles which lose their water of crystallization at 212°; they dissolve slightly in cold water, but require only three parts of boiling water for their solution, and they are freely soluble in alcohol. Solutions of G. A. have an acid reaction and a sour astringent taste; with the persalts of iron they yield a deep-blue color, and no apparent reaction occurs when they are mixed with a solution of gelatine. The gallates of the alkalies, especially if an excess of the base be present, speedily absorb oxygen, and become brown when exposed to the air; and hence they may be usefully employed in eudiometry. G. A. possesses the property of reducing the salts of gold and silver, and it is on this account that it has been employed in photography.

G. A. exists ready formed in small quantity in gall-nuts, in valonia (the acorn-cup of *quercus ægilops*), in divi-divi (the pod of *Cæsalpina coriaria*), in sumach, and other vegetables. It is formed in association with glycose from gallotannic acid (q.v.), when the latter is boiled with dilute sulphuric or hydrochloric acid; it is likewise produced by boiling a solution of gallotannic acid with caustic alkalies, or (more slowly) by simply exposing a solution of gall-nuts to the air, the process of oxygenation being apparently favored by the presence of a ferment contained in the gall-nut.

To obtain G. A., we mix powdered gall-nuts with water, and expose them freely and for a long time to the air at a temperature of 70° or 80°. The tannin or gallotannic acid becomes gradually converted into gallic acid. We pour away the supernatant brown

fluid, and take up the G. A. from the residue with boiling water, decolorize with animal charcoal, and crystallize.

When G. A. is exposed to a temperature of from 410° to 420°, it is converted into carbonic acid and *pyrogallic acid* (q.v.) ($C_{12}H_6O_6$), which is sublimed, 31 or 32 parts of the latter acid being yielded by 100 of gallic acid. The reaction is represented by the formula—

$$\overbrace{C_{14}H_6O_{10}}^{\text{Gallic Acid.}} = \overbrace{2CO_2}^{\text{Carbonic Acid.}} + \overbrace{C_{12}H_6O_6}^{\text{Pyrogallic Acid.}}$$

If G. A. is mixed with five times its weight of oil of vitriol, a crimson solution is formed, which, if gradually dropped into water, deposits a red substance, partly in granules and partly in crystals. The crystals are *rufigallic acid* ($C_{14}H_4O_8,2HO$).

G. A. is used in medicine as an astringent. The late Dr. Todd regarded it as the best styptic that we possess in all cases of internal hemorrhage, whether hemoptysis, hematemesis, or hematuria. The symptoms of Bright's disease of the kidney have also been much alleviated by its use. It may be given in doses of from 3 to 10 grains three or four times a day. As a topical agent in arresting hemorrhage from external wounds, it is greatly inferior to tannin.

GALLICAN CHURCH, the church of France, less, however, considered under the relation of geographical boundaries than in its constitution and principles of church government. The Christian faith was widely diffused in France, even during the lifetime of the apostles; and it especially flourished among the descendants of the Greek colonies of the south, and in the numerous towns and cities upon the Rhone and its confluent rivers. In the persecutions to which the early professors of Christianity were subjected, the Christians of these churches had their full share; and one of the most touching monuments of early Christian literature, is the letter of the Christians of Lyons and Vienne to their brethren in Asia, on the martyrs of these churches, which Eusebius has preserved in his *Ecclesiastical History* (book v. c. 1). Although sharing in the general literary inferiority to their eastern brethren which characterizes western ecclesiastics during the early period, the church of Gaul numbers several eminent names in the literature of the 3d, 4th, and 5th centuries. The works of Irenæus, bishop of Lyons, are among the most important for the history of doctrine of all the early patristic remains; and in the following century, Sulpicius Severus, Hilary of Poitiers, Hilary of Arles, Vincent of Lerins, Prosper, Victor, Eucherius, Salvian, and Gregory of Tours, combine to form a body of literature of which the later modern representatives of the French church are not unreasonably proud. The hierarchical organization, also, of the church of Gaul was, at a very early period, among the most complete and regular throughout the churches of western Christendom; and in the council held at Arles in 314, we may recognize the titles of many bishops of sees which are still represented in the catalogue of the French episcopacy.

But the history of the G. C., so far as regards the development of those peculiar principles which have acquired a distinctive name and status in Roman Catholic theology, begins at a much later period. We shall see elsewhere the origin and progress of the temporal power of the papacy. See PAPACY. It will be enough, in this place, to observe, that, from circumstances which are differently viewed by the opposite schools of theology, the Roman pontiffs began, from the very date of the establishment of the western empire, to exercise a large and widely extended influence over the civil as well as ecclesiastical affairs of the several European kingdoms. On the other hand, owing to the intimate connection between the church and state in most of these kingdoms, and especially to the feudal relations between the crown and the church dignitaries, most of whom held the temporalities of their benefices under the crown by the ordinary feudatory tenure, the crown also asserted a correlative claim to certain privileges in respect of ecclesiastical affairs. The satisfactory adjustment of these conflicting claims was the great problem of mediæval polity; and the alternations of the struggle between them form the staple of mediæval history. More than one of the French sovereigns engaged in a conflict with the Roman see as to the respective authority of the two powers; these conflicts naturally called out a division of opinion among the members of the church of France, one party supporting the papal claims, and the other maintaining the adverse prerogatives of the French crown, and the privileges of the national church of France. The latter party, professing to represent the rights of the G. C., have given a name to the principles which they profess; and the appellation of Gallicanism has come to designate, in general, that system in Roman Catholic theology which, while it recognizes the primacy of the Roman pontiff, by divine right, over the universal church, yet asserts the independence of national churches in many details of self-government and of local discipline, and limits the exercise of the papal prerogative by canons and decrees of general councils and by the laws of the universal church. It must be added that, while the Gallican theory to this extent claims an exemption from dependence upon the authority of the Roman pontiff, it acquiesces, on the other hand, to an almost proportionate degree, in the assumption of ecclesiastical authority on the part of the state. Gallicanism, in truth, in many of its details, falls into the grossest form of Erastianism.

We can recognize the working of these principles in the opposition which the so-

called Isidorian decretals (see ISIDORIAN DECRETALS, HINCMAR OF RHEIMS) encountered in France; and although the body of the clergy stood aloof, they were carried to their most extreme extent by Philippe le bel (or Philip the handsome) in his contest with Boniface VIII. The conflicting claims of the rival popes in the western schism (see WESTERN SCHISM) tended still more to weaken the papal authority; and the expedient which was then adopted for the extinction of the schism—viz., that of convening a general council to pronounce upon the respective claims of the pretenders to the papacy, gave prominence and significancy to what has since been regarded as one of the leading dogmas of Gallicanism—the superiority in point of authority of a general council to the pope. The details, too, of the disciplinary enactments of the councils of Constance and Basel, which were drawn up in this spirit, were mainly directed towards the limitation of the papal authority in the exercise of church patronage within the limits of the national church; and these enactments were in the main embodied into the French law by the celebrated pragmatic sanction of 1438. See PRAGMATIC SANCTION.

The pragmatic sanction was superseded in 1512 by the concordat of Leo X. with Francis I. The patronage which the French crown enjoyed under that concordat had the effect of still further nationalizing the French church, and increasing at once the subserviency of the clergy and the jealousy of the crown as to the papal interference. The great jurists, Pithou and Dupin, in asserting the liberties of the church, equally enforced the privileges of the crown. In the development of the absolutism of the monarchy, which reached its height under Louis XIV., the ecclesiastical prerogative of the crown was enlarged as much as its political authority; and a contest which arose between this monarch and Innocent XI., on the right of the crown to the so-called *Droit de Regale* (see REGALIA), led to the well-known declaration of the French clergy in 1682, which has since been regarded as the charter of Gallicanism. This formulary emanated from an assembly of the French clergy, held by royal authority in 1682, at which the celebrated Bossuet was present. It consists of four articles. The first declares that "the jurisdiction of St. Peter and his successors in the Roman see as vicars of Christ on earth, although divinely bestowed, is confined to things spiritual and appertaining to salvation, and does not extend to civil or temporal affairs." The article therefore declares "that princes are not subject in temporal things to any ecclesiastical authrity;" that they cannot be deposed "either directly or indirectly by the power of the keys, and that their subjects cannot be dispensed from their subjection or released from their allegiance." The second article renews the declaration of the council of Constance with regard to the superiority of a general council over the pope, and declares that that article is not to be restricted in its application to a period of schism such as existed at the time of the council. The third asserts that the authority of the pope is "to be restricted by the canons of the universal church," and that "the rules, customs, and institutions of the Gallican kingdom and church remain in full force." This is the article which asserts the celebrated "Gallican liberties." The fourth article, while it concedes to the pope "the chief part in questions of faith," and professes that "his decrees extend to each and every church," nevertheless maintains "that his judgment is not irreformable, unless it shall have been confirmed by the consent of the entire church." The chief rules, customs, and institutions of the G. C. referred to in the third article are, that the G. C. does not receive all the decrees of councils and of popes in matters of discipline, and that those only are in force which are so received; that the G. C. holds itself free to receive or reject the rules of the Roman chancery; that the Roman pontiff cannot levy any impost from the French clergy without their own consent; that he cannot bestow of his own motion on a foreigner any benefice within the French church; that neither he nor his legates can hear French causes in "the first instance," and that even in cases of appeal he is bound to assign native judges to hear the appeal, even when the appellant should be a metropolitan or primate; that the French bishops shall not be required to attend any general council unless with the permission of the crown. The last of these "customs," as also those which make the receiving or not receiving the general canons of discipline optional in France, and which practically throw the decision into the hands of the civil power, have been with much show of reason denominated the "slaveries" rather than the "liberties" of the Gallican church.

This "declaration" was strenuously enforced by Louis XIV.; but it was in the same proportion distasteful to the popes. It was condemned by Alexander VIII. in 1690, by Clement XI. in 1706, and again by Pius VI. in 1794; but both the acceptance of the articles and their condemnation were understood to be with certain reservations. Within the present century, and especially since the late collision between the civil and ecclesiastical authority, the opinions of the French clergy underwent a decided change. The Gallican doctrines were much less commonly held, and in a less extreme form, and where the same doctrines were adopted in other national churches, and especially in Germany (see FEBRONIANISM), under Joseph II., they fell into similar discredit with the church party.

The climax of this reaction has been seen in the conduct of the French bishops at the late Vatican council, in which a great body of them were foremost in renouncing the Gallican articles, and accepting the doctrine of papal infallibility; and even those who contended for the opposite view, in the end acquiesced in the decision of the majority.

The G. C. underwent very extensive modifications at the close of the 18th and the be-

ginning of the present century, not merely by the enactment of what was called the "civil constitution of the clergy," and which introduced into the constitution of the church a large infusion of the presbyterian, and even the democratic element, but by the concordat of Pius VII. with Bonaparte as first consul, which reduced the number of sees, brought the ecclesiastical divisions of the country into harmony with its new political distribution into departments, diminished the number of festivals, and confirmed the suppression of the ancient religious establishments and the confiscation of the church property throughout France. Compare De Maistre's *De l'Eglise Gallicane;* Dupin, *Les Libertés de l'Eglise Gallicane* (Paris, 1824); Puyol, *La Renovation du Gallicanisme au Commencement du 17e Siècle* (1876).

GALLIE'NUS, PUBLIUS LICINIUS, a Roman emperor from the year 260 A.D.—when his father Valerian, who had made him co-regent with himself, was taken prisoner by the Persians—to 268 A.D. His authority was limited almost entirely to Italy, for throughout the provinces the legions for the most part revolted, and raised their commanders to the dignity of Cæsars. Hence, the period is known in history as the time of the thirty tyrants. In the east, the honor of the Roman arms was maintained by Aurelian, Probus, and others, who found a useful ally in Odenathus, ruler of Palmyra, and his wife Zenobia (q.v.), to whom G. intrusted the care of the war against the Persians. In the west, however, dangers thickened about him. Aureolus was proclaimed emperor by the legions of Illyricum, and having marched into Italy, seized Milan, and proceeded towards Rome. The war between the two was carried on for some time with undecided success, but G., while besieging his adversary in Mediolanum (Milan), was murdered by some of his officers, 268 A.D. He was succeeded by Claudius II.

GALLINA'CEOUS BIRDS (Lat. *gallus*, a cock), or RASORES (Lat. scrapers), an order of birds, more generally valuable to man than any other order, containing at once the most important species domesticated as poultry, and those most sought after as game. The common domestic fowl may be regarded as the type of the order. Like it, the G. B. in general have a small head; a rather short bill, with the upper mandible a little arched; nostrils placed on the sides of the bill, and usually in a soft membranous space at its base; the figure bulky; the wings short, and not governed by powerful muscles, nor adapted for long or rapid flight; the feet with three toes before, and one behind—which is articulated higher than the others, and is sometimes wanting—adapted for walking on the ground and for scraping, which is much resorted to, in order to procure food and for other purposes; the digestive organs complex, the *crop* large, the *gizzard* very muscular, the *intestine* long, with two very large *cæca*. The head, at least of the males, is very generally furnished with appendages, as a crest, comb, wattles, etc. The feet of the males are also often furnished with *spurs*, and at least during the breeding season the males are very quarrelsome. The males of many species are birds of splendid plumage; that of the females is sober, but females of very advanced age often assume a plumage similar to that of the males. Some of the G. B. are polygamous, some pair at the breeding season; the nest of all of them is artless, and the males take no part in incubation, nor in the rearing of the young. The young are comparatively feathered when hatched, and are immediately able to run about and pick up food for themselves, but are for some time most affectionately tended and protected by their mother, and by her the proper food is sought for them and pointed out to them, or broken into sufficiently small pieces, and laid before them. The G. B. have unmelodious voices. Except the curassows, they make their nests on the ground. Some of them are found in almost all parts of the world. Besides those already named, guans, pheasants, grouse, partridges, quails, ptarmigans, peacocks, turkeys, guinea-fowls, tragopans, and tinamous, may be mentioned as examples of this order. Pigeons are generally ranked in it by ornithologists, but rather doubtfully, as they differ not a little from the true gallinaceous birds. See COLUMBIDÆ. Interesting analogies have been pointed out between this order of birds and the order of ruminants among mammals, in the complexity of the digestive organs, bulkiness of the frame, low intelligence, easy domestication, usefulness to man, and proneness to variation from the influence of external circumstances, giving rise to different breeds.

GAL'LINULE, *Gallinula*, a genus of birds of the family *rallidæ*, closely allied to the coots (q.v.), and having the upper mandible similarly extending on the forehead in a naked soft plate, but the toes furnished with an undivided narrow marginal membrane. This membrane, however, and the great length of the toes, enable the gallinules to swim well, and all of them are aquatic. The species are pretty numerous, some of them confined to tropical regions. One only is found in Britain, the COMMON G. (*G. chloropus*), also known as the WATER-HEN, or MOOR-HEN. It is a very widely diffused species, being found in most parts of the world. The G. is about 13 in. in length, the tail very short; the general color of the plumage deep olive-brown on the upper parts, blackish-gray beneath, the ridge of the wing and the under tail-coverts white. The bill is red at the base, and yellowish-green at the tip; the legs and toes green. In situations favorable for them, such as artificial ponds, gallinules may often be seen in considerable numbers together, swimming with a peculiar nodding motion of the head. They seek their food both on the surface of the water and by diving, partly also among the grass of meadows and river-banks. A frequent jerking of the tail is very characteristic of

them. When alarmed, they sometimes seek safety by flight, but more frequently by hiding among rushes or reeds. They make their nests near the water which they frequent, and usually on the ground among stumps, roots, and reeds; the nest contains from seven to ten eggs. The flesh of the G. is well flavored.

GALLIO, JUNIUS ANNÆUS, proconsul of Achaia in the time of Paul the apostle, 53 A.D., son of Annæus Seneca, a Roman rhetorician. His mother's name was Helvia; and L. Annæus Seneca, the philosopher, and L. Annæus Mela, the geographer, were his full brothers, his own proper name being Marcus Annæus Novatus. After receiving a careful education from his father at Cordova, he went to Rome, where he attracted the notice of L. Junius Gallio, a rhetorician of some repute, who ultimately adopted him, thus conferring upon him the name by which he is usually known. It is probable that Gallio shared the misfortune of his brothers when the latter, having incurred the enmity of Messalina, were banished to Corsica; and that all three returned together to Rome, when Agrippina selected Seneca to be tutor to Nero. Towards the close of the reign of Claudius, Gallio received the proconsulship of the newly constituted senatorial province of Achaia, but seems to have been compelled by ill health to resign the post within a few years. In the fifth year of Nero's reign, we hear of him as being again in Rome, and from the same authority we learn that he became one of the last victims of that tyrant.

GALLIOT, a Dutch vessel carrying a main and a mizzen mast, and a large gaff-mainsail. Galliots—strong-built, flat-bottomed ships—of 400 to 500 tons burden, were formerly used also as bomb-vessels.

GALLIP'OLI (the *Callipolis* of the Greeks), an important commercial t. of southern Italy, in the province of Lece, is beautifully situated on the eastern shore of the gulf of Taranto, on a steep insulated rock in the sea, connected with the mainland by a fine arched bridge of stone. It has a good harbor, although somewhat difficult of access, owing to the rocks surrounding its entrance, and in time of war is an important position, being strongly protected by fortifications and a castle, as well as by the peculiarity of its site. G. is remarkable for its oil-tanks, excavated in the solid limestone, in which the famous oil of Puglia is deposited for exportation. Pop. '72, 8,027. It is the see of a bishop. In one year the revenue from the oil-trade amounted to more than 8,000,000 francs. Other interesting features of the place are the ancient fountain, a fine monument of antiquity, and adorned with antique figures in bas-relief; the castle, erected by Charles of Anjou, commanding the port and bridge, and possessing considerable defensive strength; and the cathedral, erected in 1629 by Francesco Bischettini, and containing some fine paintings of Coppola.

It is said that Christianity was introduced here as early as 44 A.D. In 450, the town was sacked by the Vandals; in 1284, it was destroyed and almost depopulated by Charles of Anjou; and during subsequent centuries, suffered severely from the Venetians, French, Spaniards, and Turks. See *Viaggi in Sicilia ed in Gallipoli*, by baron Riedesel.

GALLIP'OLI, an important t. and seaport of Turkey in Europe, in the province of Adrianople, is situated on the peninsula of the same name, at the north-eastern extremity of the strait of the Dardanelles, and is 90 m. s. of Adrianople, and about 130 m. w.s.w. of Constantinople. It was once fortified, but its only defense now is "a sorry square castle with an old tower." G. is poorly and irregularly built, its houses miserable, and its streets dirty, but its bazaars are extensive and well stocked. It is the most important town on the Hellespont, has two ports, numerous fountains and mosques, and its merchants, comprising men of all nations, carry on a flourishing trade in corn, wine, oil, etc. The exports in 1874 were valued at £228,461; the imports at £129,750. Pop. about 20,000.

G. is the see of a Greek bishop. In the town and neighborhood are seen many remains of ancient sculpture and architecture, the most noteworthy of which are the magazine and cellars built by Justinian. The town was taken by the Turks in 1357, and formed their earliest European possession.

GALLIP'OLI, PENINSULA OF (the ancient Thracian Chersonesus), a portion of the province of Adrianople, in European Turkey, is situated between 40° 3' and 40° 38' n., and separates the strait of Dardanelles on the e. from the gulf of Saros on the west. It extends in a s.w. direction, is about 55 m. in length, and varies from 4 to 13 m. in breadth. The principal town on the peninsula is Gallipoli (q.v.).

GAL'LIP'OLIS, a city in Gallia co., Ohio, on the Ohio river, at the terminus of the Gallipolis, McArthur, and Columbus railroad; 56 m. s.e. of Chillicothe. It contains a court-house, the Gallia academy and other schools, several churches, steam flouring-mills, and several important manufacturing establishments. Pop. '70, 3,711.

GAL'LIPOT, the name given to a pot painted and glazed, commonly used for medicine. The origin of the name is uncertain, some deriving it from the Dutch *gleye*, clay, or *glei*, glaze, and others from the Spanish *gala*. There seems to be some doubt whether the word "galley" does not apply to the shape. Glazed colored tiles, however, were called "galletyles." The earliest mention of gallipots is in sir T. Howard's Household Book of the year 1465, edited by the Roxburghe club, *Archæol. Jour.*, 1861, p. 138.

GALLISSONNIÈRE, ROLAND MICHEL BARRIN, Marquis de la, 1693–1756; the son of a gen. of the knights of Malta; entered the French navy, 1710; while still only of the rank of capt., was created gov.gen. of Canada, where he displayed great energy in naval construction, and in establishing a line of forts between Canada and Louisiana. The Indians were at first inclined to despise him on account of his small stature, but upon further acquaintance, learned to appreciate his qualities, and he was both loved and respected by them. During his term of office, troubles with the English were frequent. G. was next appointed chief of the bureau of maps and charts, with the rank of *chef d'escadre*. In 1756, he defeated admiral Byng off Minorca (for which defeat Byng was punished with death), but the fatigue and excitement of this action were too severe for Gallissonnière's health; he was obliged to give up the command, and died soon afterwards at Nemours.

GALLITZIN, a princely family of Russia, of which many members have been notable. In 1514, prince MIKHAIL commanded a Russian army against the Poles; he was defeated by Ostrogski, and kept a prisoner 38 years, with his brother Dimitri. Soon after his release, Mikhail died in a convent. Prince VASILI in 1605 espoused the cause of the usurper Demetrius, murdered the son of Boris Godunoff, was rewarded by Demetrius, but at last conspired against him, and was a party to his death. He was also concerned in the conspiracy which overthrew Demetrius's successor, and was the leader of the deputation which offered the Russian crown to the son of Sigismund of Poland. The offer was deemed an insult, and the envoys were imprisoned at Kiev, where Vasili died. Prince VASILI, called the great, b. 1633, fought against the Turks, and became attaman (chief leader) of the Cossacks. He supported the designs of Sophia against her brother Peter the great, and when the conspiracy was quelled, he was banished to Archangel, where he died. Prince MIKHAIL, b. 1674, was greatly distinguished as a commander in the wars of Peter the great; Catherine created him field-marshal. Prince ALEXANDER, son of prince M., b. 1718, served with distinction under prince Eugene, dying in 1783. DIMITRI, b. 1721, was envoy to Austria, but is better known as the founder of a great hospital in Moscow. Another DIMITRI, b. 1735, was envoy to France and Holland, and distinguished himself as a writer on scientific subjects. His wife AMALIE, b. 1748, became the center of a band of religious writers, and was herself remarkable for literary ability as well as for personal beauty. Prince SERGEI distinguished himself in the wars with the Turks, Poles, and Austrians, from 1794 till 1809. EMANUEL, b. 1834, has gained distinction in the Russian army, and as a writer of books of travel.

GALLITZIN, DEMETRIUS AUGUSTINE, Prince, 1770–1840; a Russian missionary priest, son of the Russian ambassador at Paris, prince Gallitzin, and of the princess Amelie von Schmettau. His father was a freethinker, but he was mainly educated by his mother, and owing to her influence became a Roman Catholic in 1787. He was an officer of the Russian guard, and served for a time as a staff officer in the Austrian force in Brabant, but received his dismissal and came to America, where he embraced the opinions of the Sulpitians, studied theology at Baltimore, and in 1795, took priest's orders. He officiated at Conewango, Pa., and other places in the Atlantic states. In 1798, he founded the Roman Catholic town of Loretto, Cambria co., Pa., expending a large fortune in the work. He was known by the name of "father Smith" during this portion of his career, and labored with the greatest zeal. In 1809, he resumed his original name. He wrote *Defense of Catholic Principles; Appeal to the Protestant Public; On the Scriptures;* and other works.

GALLITZIN, ELIZABETH, 1776–1843; a member of the Roman Catholic order of the Sacred Heart, who came to America in 1840 to visit the houses of the order. She was the founder of the establishment in Houston street, New York city, and of other establishments in Pennsylvania and the western states.

GALLIUM, one of the recently discovered elements, named in honor of France. It is a metal, having an atomic weight of 69.9: sp. gr. of solid metal is 5.956, liquid 6.069; melting point 86.27°, so that it liquifies when held in the hand. The liquid metal is silvery white, adhering to glass, and forming a mirror. It may be cooled several degrees below the melting point, if kept undisturbed, but on agitating it by dropping in a piece of the solid metal, it immediately crystallizes in an octohedral form. It may be raised to a red heat without volatilizing. It is not easily attacked by cold nitric acid, but hydrochloric acid readily dissolves it, forming a very deliquescent and soluble chloride. It furnishes also a corresponding bromide and iodide, and an ammonio-gallic alum. As a base it holds a rank between aluminium and indium. It gives with the spectroscope two very brilliant lines in the violet part of the spectrum. Gallium was discovered by Lecoq de Boisbaudran in 1875 in the spectroscopic examination of zinc blende.

GALLIVATS, large row-boats, formérly and still to some extent used in eastern waters. They rarely exceed seventy tons, carry two masts with high triangular sails, and are generally armed with a few small swivel guns, fastened on the bulwarks. The Malay pirates employ these swift but somewhat fragile vessels.

GALLOMA'NIA. See ANGLOMANIA.

GALLON, the standard measure for liquids and dry goods throughout the United Kingdom. It has existed as a measure from the earliest times, and, in consequence, has undergone many changes. In the time of Henry III., it was enacted that the G. should be 8 lbs. of 12 ozs. each, an ounce being the weight of 640 dry grains of wheat from the middle of the ear.

In 1650, there were three distinct G. measures—viz., (1) the G. measure in common use, which contained about 231 cub. in.: (2) the customary standard at the guildhall, which, though not a legal standard, was frequently referred to as such, even by the law-officers of the crown; and though generally estimated at 231 cub. in., in reality contained only 224: (3) there was also the legal standard measure, preserved at the treasury, which contained 282 cub. inches.

Besides these three, there was another G. measure frequently employed for measuring corn, called the Winchester gallon. This measure, though directed in William III.'s reign to contain 269 cub. in., was soon afterwards changed to 272¼ cub. in., at which value it remained for a long period.

In 1706, the G. of 231 cub. in. was made the standard wine gallon.

These measures were gradually changed in value, and appropriated to the measurement of particular substances, till, in 1825, just before the passing of the "act for ascertaining and establishing uniformity of weights and measures," they stood thus:

In old dry or corn measure,	the gallon = 268.6	cubic inches.
In old wine measure,	" " = 230.85	" "
In old ale and beer measure,	" " = 282	" "

In Jan., 1826, when the above-mentioned act came into operation, all these measures were abolished, and it was enacted that the standard measure of capacity for all liquids and for dry goods not measured by heaping, shall be a G. containing 10 lbs. av. of distilled water, weighed in air (the barometer being at 30 in., and the thermometer at 62°).

This gives 277.274 cub. in. for the imperial G., and by subdivision or multiplication of this standard, the other measures can easily be found. See WEIGHTS AND MEASURES.

GALLOON', a narrow fabric composed of silk or worsted, or of both. It is usually employed for binding garments, curtains, etc. The small band worn round gentlemen's hats is an example.

GALLOTAN'NIC ACID ($C_{54}H_{22}O_{34}$) is the most important of the various forms of tannin or tannic acid. It usually occurs as a spongy, light, inodorous, colorless, or faintly yellow mass, which is easily reduced to a fine powder, which possesses a strongly astringent, but not a bitter taste. It is freely soluble in water, the solution reddening litmus paper, and dissolving the carbonates with effervescence. With the persalts of iron, G. A. gives a blackish blue precipitate of gallotannate of iron, and even when the iron solution is extremely dilute, a violet tint is evolved. This gallotannate of iron is the basis of ordinary writing ink (q.v.); and the reaction that we have described is so sensitive, that G. A. is employed in the laboratory as a test for the detection of the persalts of iron. G. A. likewise precipitates tartar emetic, nearly all the vegetable alkaloids (morphia, quinia, etc.), the albuminates, and gelatine. If a piece of raw hide, freed from hair, be immersed in a solution of G. A., the gelatigenous tissue and the acid combine, and leather is formed; and if the skin be of sufficient size, all the G. A. is removed from the solution.

G. A. fuses when exposed to heat, and at a temperature of about 120° it is decomposed, and yields pyrogallic acid ($C_{12}H_6O_6$) and metagallic acid ($C_{12}H_4O_4$), while water and carbonic acid are expelled. When a watery solution of G. A. is excluded from the air, it remains unchanged; but if the air is allowed free access to it, a fungous or moldy growth is developed, oxygen is absorbed, carbonic acid is given off, and the G. A. becomes decomposed into gallic acid (q.v.) and sugar. The same decomposition is more rapidly induced by the action of dilute sulphuric acid, the reaction being exhibited in the following formula:

$$\overbrace{C_{54}H_{22}O_{34}}^{\text{Gallotannic acid.}} + \overbrace{8HO}^{\text{Water.}} = \overbrace{3(C_{14}H_6O_{10})}^{\text{Gallic acid.}} + \overbrace{C_{12}H_{12}O_{12}}^{\text{Sugar.}}$$

On boiling G. A. in a concentrated solution of potash, gallic acid is also formed.

The composition of the salts of this acid is but imperfectly known, but the acid is generally considered as tribasic. None of the salts crystallize, and when in solution or in a moist state, they rapidly absorb oxygen, and become decomposed.

G. A. occurs in large quantity in the gall-nut, which contains, according to Pelouze, as much as 40 per cent of this acid, and 3.5 per cent of gallic acid (Guibourt has found that some nuts contain as much as 65 per cent of G. A.); it is likewise found in all parts of the gall or dyer's oak (*quercus infectoria*), in sumach (*rhus coriaria*), and in green tea.

The best method of obtaining it is from powdered gall-nuts, by extraction with commercial ether (which contains about 10 per cent of water), in the percolation or displacement apparatus.

G. A. is employed in medicine, in chemistry, and in the arts. Its uses in medicine are due to its powerful astringent action. It is employed topically as a styptic in wounds, bleeding gums, piles, etc., and internally as an astringent in hemorrhage from the lungs, stomach, bowels, etc.; as we know that it becomes converted into gallic acid in its passage through the system, it is probably the latter acid which acts on remote parts when G. A. is administered. Internally, it may be given in doses of from three to ten grains, three or four times a day, in pills or in solution. It may be used as an astringent gargle or lotion, in the form of a watery solution containing three or more grains to the ounce. The *compound ointment of galls*, which is the best topical remedy for piles without hemorrhage, owes its efficacy to the G. A. contained in the powdered galls.

In chemistry, it is used in solution as a test for gelatine, persalts of iron, etc.; and in the arts, it serves various useful processes, especially in relation to the preparation of leather, and the manufacture of white wines.

GAL'LOWAY, an ancient province in the s.w. of Scotland, now mostly comprised in the shire of Wigtown and stewartry of Kirkcudbright. The extent and early history of G. are alike obscure. By some historians, it has been asserted to have comprehended, in addition to Kirkcudbright and Wigtown, Nithsdale, Annandale, Teviotdale, Carrick, Kyle, Cunningham, and Renfrewshire; but the evidence for such assertion is not satisfactory. Gallwegia is mentioned in 1124, in a charter granted by David I. of Scotland to the monks of Selkirk, and at that time its dimensions appear to have been no larger than those the modern application of the name implies. Of the eight tributary princes who are said to have waited upon Edgar king of England at Chester, in 973, one was "Jacobus rex Galwalliæ." The name, however, must have come into use after the time of Bede the historian (d. 735), for in speaking of the province, which then formed part of the Bernician or Northumbrian kingdom, he makes no mention of it. Its origin is doubtful, but has obvious reference to the Gaelic people by whom it was possessed. The original inhabitants of the country appear to have been of Celtic origin; they are believed to have formed two distinct tribes, the Selgovæ and Novantes—the former holding the country e. of the Dee, along with a portion of Dumfriesshire, while the latter held the portion lying to the west. After the departure of the Romans, in the first half of the 5th c., G. was overrun by the Anglo-Saxons of Northumbria, by whom, however, the native Celtic inhabitants do not appear to have been ever thoroughly subdued. About the 12th c., G. is spoken of by English writers as "the land of the Picts," and its inhabitants as "the Picts." In Scottish charters, the inhabitants were called simply "Gallovidienses," or men of Galloway. G. was ruled by its own princes, the kings of Scotland only exercising a nominal sovereignty over it, and it was not until the reign of Alexander II. that the power of these great chieftains was completely broken by the crown. The last of them, Alan of Galloway, constable of Scotland, d. in 1233, when his great possessions were divided among his three daughters. See Skene's *Celtic Scotland* (1876). For the extent, population, natural productions, etc., of G., see KIRKCUDBRIGHTSHIRE and WIGTOWNSHIRE.

GALLOWAY, JOSEPH, LL.D.; 1730–1803; b. Md. He was a lawyer and a member of the Pennsylvania colonial assembly. In 1774, he was a delegate to the first congress, but his sympathies being on the side of England, he became a conspicuous tory. In 1778, he settled in England with his daughter. He published *Speech in Answer to John Dickinson; Candid Examination of the Mutual Claims of Great Britain and the Colonies; Letters to a Nobleman;* and *Reply to Sir William Howe.*

GALLOWAY, MULL OF, a rocky headland, the southern extremity of the peninsula called the Rinns of Galloway, in Wigtownshire, is the most southern point of Scotland. It is 1½ m. long, and ½ of a mile broad. On this headland, in lat. 54° 38′ n., and long. 4° 52′ w., is a light-house, 325 ft. above the level of the sea, the light of which is seen at the distance of 21 nautical miles.

GALLOWS, PIT and G. See FOSSA ET FURCA; also EXECUTION, HANGING.

GALLOWS-BITS, the name applied on board ship to two strong frames of oak, on which the spare topmasts and yards are lashed.

GALLS, or GALL-NUTS, are of various shapes, but the oak galls chiefly used in commerce are nearly globular, with slightly pointed excrescences sparingly placed on their surface. They are remarkable for containing a peculiar acid called *gallic*, which is only an altered condition of tannic acid, and their value is entirely due to the great accumulation of this principle in the diseased condition of the vegetable tissue which constitutes the gall. This gallic acid (q.v.) is easily separated in the form of beautiful white acicular crystals, which, after a little exposure, become pale yellow. It is in extensive demand as a fixing agent for photographic pictures. Until this demand was created, only three or four kinds of G. were known in commerce, and these were almost wholly employed for dyeing purposes, a small quantity of the common Turkish G. being also used medicinally; now, several others are imported in considerable quantities. The following are the chief:

1. The Turkish G., of two kinds, *blue* and *white;* these are by far the most common in use. They are chiefly imported from Constantinople and Smyrna, from which

places the average annual imports amount to 300 tons—an enormous quantity when we consider how they are produced, and the industry necessary to collect so vast a quantity. They are each about the size of a round nutmeg, and the blue, which are the best, are entire, being gathered before the escape of the insect. The so called white G. are of a yellowish-brown color, and each is perforated with a small round hole, about the sixteenth of an inch in diameter, whence the insect has escaped. These G. are produced by a species of cynips (*C. quercus-galli*) on the dyer's oak (*quercus infectoria*), a native of Asia Minor, from the Bosphorus to Syria, and from the Grecian archipelago to the frontiers of Persia. Of this kind of gall, several varieties are known in commerce, as the Aleppo G.; the Syrian or Mosul G., which are the best known; the Tripoli Taraplus or Tarablous G., obtained from Constantinople, and the Smyrna galls.

2. The small Aleppo or coriander gall, which is generally about the size of a large pea. They are always perforated or empty G., and are of a brownish-yellow color, round, and with small blunt spines. The quantity used in this country is not very large.

3. The large Bassorah, Bussorah, or Mecca G., which are the largest G. known in commerce; they are as large as an Orleans plum, smooth, except a ring of curious slightly raised excrescences sometimes found round the middle, dividing the gall into two hemispheres. They are reddish brown, and are said, when on the trees (*quercus infectoria*), to be colored as brightly as apples. These are the apples of Sodom, or the Dead sea apples, bright to the eye, but filled with a gritty astringent matter, which is likened to ashes; it is formed on the *quercus infectoria* by *cynips insana*. These are not extensively imported.

4. The acorn gall, Knoppern, Knobben, Hungarian, or German gall. This is found chiefly in Hungary, and is much used by the German dyers; it is also occasionally used in this country. It is a curious irregular-shaped brown gall, deeply furrowed, and covered with angular excrescences. It is produced on the common oak (*quercus pendunculata*) by *cynips quercus calycis.*

5. The small East Indian G. called Mahee, and Sumrut-ool-toorfa, are obtained from the Indian tamarisk (*tamarix Indica*). They are very small, about the size and color of tares, and are so rough and irregular in form, that they look rather like little lumps of dried garden soil.

6. The Chinese G., or woo-pei-tsze. These very curious vegetable excrescences were regarded only as curiosities some years since, but they now form regular articles of commerce. They are of a very irregular shape, branching out sometimes like fingers. Their length seldom exceeds 2 in.; they are rarely more than ½ in. in diameter at the base, where they spring from the tree, but they spread out as much sometimes as 1½ to 2 inches. When broken, they are found to consist of a thin shell, not thicker than a walnut shell, of a dark-yellowish or reddish-brown color internally, and semi-transparent; but externally they are covered with very fine down, and consequently look like the young horns of a stag when just budding. They are produced on the *rhus semialata* (see SUMACH), by an insect not yet known to science. Since the Japanese ports have been opened to British commerce, considerable imports of these curious G. have been received from that country. They are rather more branched, the branches or lobes being smaller than in the Chinese variety, but in all other respects they are identical.

A very great many G. are known in most parts of the world, and in our own country the oaks yield numerous species, but those above enumerated are the G. of commerce: few others have ever been found to pay the expense of collecting. G. are extensively used in dyeing, chiefly for the production of black colors, with logwood and the salts of iron, either for dyeing in the piece, or printing patterns; in each case, the material is first submitted to the action of a solution of the G., and afterwards to another of the dye-wood and iron salt. They are also an important constituent in writing ink (see INK), and are used in tanning the finer kinds of fancy leathers.

GALL-STONE. See CALCULUS.

GALLUP, JOSEPH ADAM, 1769–1849; b. Conn., and graduated in medicine at Dartmouth college. In 1800, he settled in Vermont, and began to write for the newspapers. In 1820–23, he presided over the Castleton academy, and about the same time lectured in the university of Vermont. He published *Sketches of Epidemic Diseases in the State of Vermont; Pathological Reflections on the Supertonic State of Disease;* and *Outlines of the Institutes of Medicine.*

GALLUP'PI, or GALUPPI, PASQUALE, 1770–1846; an Italian philosopher, educated in the university of Naples. He entered the government service, and was for many years employed in the office of the administration of finances. Though apart from academic influences, he pursued his favorite studies; and it was not till he had reached the age of 60, and had become widely known by his philosophical writings, that he was called to a chair in the university of Naples, which he held till his death. Galluppi's first work was an essay on analysis and synthesis. This was followed by the important *Saggio Filosofico Sulla Critica della Conoscenza*, in 6 vols. In the *Lettere Filosofiche*, etc., by which, through Piesse's translation into French, he is best known to foreigners, G. traces his own philosophical development from the empiricism of the 18th c. writers, through the Kantian criticism, to his final speculative views, in many respects resem-

bling the doctrines of the Scotch school as amended by Hamilton. His systematic work, *Elementi di Filosofia*, was long used as a text-book for instruction in the Italian colleges. G., though in many respects Kantian, can hardly be said to have fully taken up the speculative significance of the *Critique of Pure Reason*. He accepts the Kantian demonstrations of the necessary unity of consciousness as the indispensable factor in knowledge, regards our knowledge of the *ego* as knowledge of substance, maintains that in external perception, or, as he puts it, in sensation, we are directly cognizant of the real thing, and holds that the existence of the unconditioned is given in knowledge as the necessary correlate of the conditioned, but rejects entirely the *a priori* element which is the distinguishing characteristic of the Kantian doctrine of cognition. All judgments, according to him, are ultimately identical. On the other hand, G. exaggerates the place and importance of the moral reason; with Kant, he finds objective truth in the ideas of desert and duty, and admits that ethical judgments are *a priori*, without endeavoring to explain, in accordance with his theoretical views, how such judgments are at all possible.

GALLUS, C. CORNELIUS, B.C. 66–26; a Roman poet, orator, and politician, b. in Gaul, of humble origin. Going to Rome he was taught by the same master as Virgil and Varius. In political life, he espoused the cause of Octavianus, and as a reward for his services was made prefect of Egypt. His conduct in this position afterwards brought him into disgrace with Augustus; and, dreading the exposure of his arrogance, extortion, and cruelty, he put an end to his life by throwing himself on his sword. G. acquired among his contemporaries a high repute for intellect. He associated on terms of equality with Virgil, Ovid, Varius, Asinius Pollio, and others; and on account of his four books of elegies, Ovid claimed for him the first place among the elegiac poets of Rome. His fame as an orator was hardly inferior to his renown as a poet; but not a fragment of his composition has descended to our times.

GALOCHES. See GOLOSHES.

GALOIS, EVARISTE, 1811–32; a French mathematician. Much of his attention was devoted to researches on the resolubility of algebraic equations by radicals. But these researches, crowning as it were the previous labors of Lagrange, Gauss, and Abel, have in a signal manner advanced the theory, and it is not too much to say that they are the foundation of all that has since been done, or is doing, in the subject. The fundamental notion consists in the establishment of a group of permutations of the roots of an equation, such that every function of the roots invariable by the substitutions of the group is rationally known, and reciprocally that every rationally determined function of the roots is invariable by the substitutions of the groups. As part of the theory (also the investigation has a very high independent value as regards the theory of numbers, to which it properly belongs), Galois introduces the notion of the imaginary roots of an irreducible congruence of a degree superior to unity. He was killed in a duel.

GALT, a thriving t. of Canada, in the co. of Waterloo, province of Ontario, principally built of stone. It stands on both sides of the Grand river, about 55 m. from its entrance into lake Erie. The eastern and western parts of the town are connected by two wooden bridges, resting on massive stone piers. The environs of the town are noted for their beauty. The first house of G. was built in 1816, amid a dense forest of pines, which then covered its site. The inhabitants numbered, in 1871, 3,827, the majority being of Scotch descent. It contains numerous places of public worship—Presbyterian, Methodist, Episcopal, Roman Catholic, and Baptist. It supports one grammar and one common school; the average attendance of the latter being about 500; and has an extensive library and public reading-room in connection with a mechanics' institute. Among its industrial establishments are several woolen manufactories and iron foundries; there are also extensive flour-mills. The manufacture of edge-tools is carried on to a large extent. The trade of the town is greatly promoted by the Great Western railway, a branch of which passes through Galt. The local affairs of G. are managed by a mayor and council of 15 members.

GALT, Sir ALEXANDER TILLOCH, b. England, 1817, son of John, the Scotch author. Alexander became manager of the British-American land company, which he rescued from insolvency and brought to a high degree of prosperity. He was interested in the establishment of the railroad from Montreal to Portland. In 1858, he became minister of finance in the Cartier administration in Canada. In 1862 he resigned, and returned to office in 1864, retiring again in 1866. He was one of the commissioners appointed to promote the confederation of the colonies.

GALT, JOHN, a distinguished Scottish novelist, was b. in Irvine, on May 2, 1779. His father, who was a captain of a ship in the West Indian trade, left Ayrshire in 1780, and fixed his residence in Greenock. In that town, G. received his education, and was then placed in the custom-house. He remained there till 1804, when, panting after literary distinction, he proceeded to London with an epic poem on the battle of Largs in his portmanteau. On reaching the metropolis, he printed his epic, but becoming dissatisfied with its merits, he ultimately withdrew it from the market. After a few years, his health began to fail, and he was obliged to seek relief in a more genial climate. At Gibraltar, he made the acquaintance of lord Byron—flushed with his first success in the

English Bards and Scotch Reviewers—and his friend Mr. Hobhouse, and the three travelers became fellow-voyagers. Separating from his new friends, G. visited Sicily, then Malta, and finally repaired to Greece, where he again renewed his acquaintance with Byron, and had an interview with Ali Pasha. He then proceeded to Constantinople, and afterwards to the shores of the Black sea. On one occasion, when detained by quarantine, he sketched six dramas, which were afterwards given to the world. On his return, he published *Letters from the Levant* with considerable success, but first displayed the possession of distinct and individual power in *The Ayrshire Legatees*, which was published in *Blackwood's Magazine* in 1820. *The Annals of the Parish*, a far superior work, appeared the year after, and met with unquestionable success. Having hit on the true vein, he worked it assiduously, and produced *Sir Andrew Wylie; The Entail; The Steam-boat;* and *The Provost*, with great rapidity. He then diverged into the walk of historical romance, and published *Ringan Gilhaize*, a tale of the Covenanters; *The Spaewife; Rothelan;* and *The Omen*. These works, although full of striking scenes, and abounding in powerful writing, were not so successful as his earlier and less ambitious performances. G., whose hands were always equally full of literary and commercial undertakings, was now busily engaged in the formation of the Canada company, but before he left England for his distant scene of labor, he gave to the world *The Last of the Lairds*.

He departed for Canada in 1826, but, disappointed in his expectations, he returned to England in the course of a year or two, and recommenced his literary labors with his usual rapidity. In a short time, he published a novel, *Lawrie Todd*, which was followed by *Southennan*, a romance of the days of queen Mary; and this by a *Life of Lord Byron*, which ran through several editions, but which was roughly handled by the critics. In 1834, he published *Literary Miscellanies* in three volumes. He now returned to Scotland, utterly broken in health and spirits; and after suffering several attacks of paralysis, he expired at Greenock on April 11, 1839.

G. was a voluminous and unequal writer; but while several of his productions are already forgotten, others of them will perish only with the language. In depicting provincialism, in representing life as it flows on in small towns and villages—communities in which the successful shopkeeper may aspire to be the chief magistrate, and in which the minister is the most important personage—he is without a rival. He has founded a school of writers in Scotland, but as yet his followers have produced no work equal to *The Provost* or *The Annals of the Parish*.

GALTON, Francis, b. England, 1822; grandson of Dr. Erasmus Darwin; graduated at Trinity college, Cambridge, 1844; traveled in n. Africa, and on the White Nile, then rarely visited, in 1846, and afterwards undertook the exploration of the western regions of s. Africa in 1850, starting from Walfisch bay. For this journey, of which he afterwards published an account, *Narrative of an Explorer in Tropical South Africa*, he received the gold medal of the royal geographical society, in whose proceedings he subsequently took an active share, first as member of council, and for several years as one of its secretaries. Mr. Galton is also the author of the *Art of Travel, or Shifts and Contrivances in Wild Countries*, a work which has gone through numerous editions, and which has been warmly appreciated by travelers and emigrants; also of *Meteorographica*, the first attempt, on a large scale, to chart the progress of all the elements of the weather, and through which the existence and theory of anti-cyclones was first established by him. He was appointed, on behalf of the royal society, a member of the committee of the board of trade. He has published several works on heredity. He has held office or membership in many scientific societies.

GALUP'PI, Baldassare, 1706–85; an Italian composer, the son of a barber, educated by Lotti. He wrote an opera when 16 years of age, and it was a failure; but his successful comic opera named *Dorinda*, produced seven years later, laid the foundation of his fame. He was a prolific writer; no less than 70 of his operas are enumerated, though none have kept the stage. G. resided in London between 1741 and 1744; and afterwards was in St. Petersburg till 1768, as imperial conductor of music, in high honor at the court of the czar. Here he produced his best tragic opera. He is said to have introduced Italian church-music in Russia. In 1768, he resumed his position as organist of the cathedral of St. Marks at Venice, to which he had been appointed in 1762, and which had been kept open for him during his absence. When he died he left 50,000 lire to the poor of Venice. His best comic opera bears the title *Il mondo della Luna*.

GALVA, a village in Henry co., Ill., on the Chicago, Burlington, and Quincy railroad, where the Peoria and Rock Island road crosses; 141 m. w.s.w. of Chicago; pop. 2,160. It is in a rich agricultural and coal-mining district, on the divide between the Illinois and Mississippi basins. In 1872, nearly the whole village was burned.

GALVA'NI, Luigi, a famous physician and anatomist, was b. at Bologna, Sept. 9, 1737. At an early age, he evinced a strong inclination to devote himself to a monastic life, and his studies in the university of Bologna were, with this view, chiefly directed to scholastic philosophy, rather than to general science. Swayed, however, by the persuasion of his friends, he relinquished his intention of entering the church, and determined to follow the profession of medicine, selecting for special investigation the depart

ments of physiology and comparative anatomy. At this time, he enjoyed the benefit of studying under some of the most eminent medical professors of the day—Beccaria, Tacconi, and Galeazzi, whose talented daughter he subsequently married. So distinguished by his knowledge and ability did he soon become, that in 1762 he was elected professor of anatomy in the institute of his native city, when his lectures, although not remarkable for eloquence, were clear, accurate, and comprehensive, and enjoyed much popularity. His writings are not numerous, but all contain valuable scientific matter, and are characterized by a rare precision and minuteness of details. Two treatises, which added considerably to his reputation, are—*Considerations on the Urinary Organs*, and *On the Organs of Hearing of Birds*. But to a purely casual discovery G. owes the wide celebrity attached to his name. Many versions of this circumstance have obtained credence; but the simple fact seems to be, that G.'s wife, a woman of penetrating intellect, happened one day to witness with surprise the convulsive muscular movements produced in a skinned frog by its inanimate body having been accidentally brought into contact with a scalpel which lay on the table, and had become charged by contact with an adjoining electrical machine. She hastened to communicate the interesting phenomenon to her husband, who at once instituted a prolonged series of experiments. See GALVANISM, and ELECTRICITY, ANIMAL. G. died Dec. 4, 1798. Some time previously, he had lost in his wife a cherished companion, and was deprived of all his public emoluments, in consequence of his refusal to take the oaths prescribed by the Cisalpine republic, of which Bologna then formed a part. His writings have been chiefly published in the memoirs of the Bologna institute of sciences, including the most remarkable production of his pen, the treatise entitled *De Viribus Electricitatis in Motu Musculari Commentarius*.

GAL'VANISM is that branch of the science of electricity which treats of the electric currents arising from chemical action, more particularly from that attending the dissolution of metals. It is sometimes called dynamical electricity, because it deals with current electricity, or electricity in motion, and it thus distinguished from frictional electricity (q.v.), which is called statical in consequence of its investigating the electric condition of bodies in which electricity remains insulated or stationary. These terms, although in the main thus properly applied, are in all strictness applicable to both sciences. Frictional electricity, though small in quantity, can pass in a sensible current, and galvanic electricity, though small in tension, can be made to manifest the attractions and repulsions of stationary electricity. Thus the series of discharges which are transmitted in a wire connecting the prime conductor of a machine in action with the ground, possesses, though feebly, the characteristics of a galvanic current; and the insulated poles of a many-celled galvanic battery, manifest before the current begins the electric tension of the friction machine. The other branches of current electricity will be found under INDUCTION OF ELECTRIC CURRENTS, MAGNETO-ELECTRICITY, and THERMO-ELECTRICITY.

Historical Sketch.—The science of G. dates from the close of the 18th century. In the year 1780, Galvani, in making investigations on the nervous irritability of cold-blooded animals, discovered by accident that the limbs of a recently killed frog, when hung by the crural nerve on a metal support near an electric machine, contracted convulsively at the recurrence of each spark. This he properly accounted for by the back-stroke. See ELECTRICITY. Six years afterwards (1786), in experimenting on atmospheric electricity with frog limbs as delicate electroscopes, he obtained, also accidentally, the same convulsions by bringing the copper hook on which the nerve hung, and the limb itself, simultaneously in contact with an iron railing. The similarity of the result led him to attribute it to the same cause—viz., electricity either existing in the limb itself or produced in the conducting arc of metal. On consideration, he adopted the former hypothesis, and looked upon the limb a sa self-charging Leyden jar, with the nerve as the brass knob and wire, the interior of the muscle as the inner coating, its exterior the outer coating, and the metal arc as the discharging tongs. See ELECTRICITY, ANIMAL. He first published his researches in 1791. Volta, 1792, discarded the account given by Galvani of his experiment; and from the fact that the convulsions in question took place with more energy when there were two metals in the conducting arc instead of one, attributed the source of electricity to the heterogeneity of the metals employed. He maintained that at the surface of contact of two different metals an electric force arising from their heterogeneity is generated, which throws them into different tensions. This doctrine forms the fundamental principle of the *contact theory* of galvanism. In reply to Volta, Galvani proved incontestably that the contraction in the limbs of the frog took place when only one metal was employed, and even when the conductor was not of metal at all. Subsequent discovery has proved Galvani to be partly right in attributing the cause of these convulsions to animal electricity, and Volta also to be partly right in attributing them to electricity generated in the metal arc, for both causes may be at work in producing the result. Volta's theory of contact is still maintained, though another theory obtains no less support which attributes the source of galvanic electricity to the chemical action of a liquid on a metal coupled with another metal less easily acted on than itself. Fabroni, a professor at Florence, was the first (1792) to suggest chemical action as one of the causes at work in Galvani's experiment. Volta did not accept of Galvani's vindication, but supported his theory by several apparently con-

clusive experiments. In 1799, he constructed, as the crowning evidence of the truth of his reasoning, his pile, and with it properly begins the history of galvanism. To Galvani is thus due the merit of discovering a new manifestation of electricity; to Volta is due the merit of displaying in it a source of power of incalculable importance, and which, but for his genius, might have remained among the barren curiosities of science. Hence it becomes a question of some difficulty to decide to which of the two the science we are discussing owes its origin—whether it is to be called Galvanism or Voltaism. Priority of discovery has led men generally to decide in favor of Galvani, although Volta has almost equal claim to have his name attached to the science.

The first account of Volta's pile reached England in a letter to sir Joseph Banks by the inventor (1800). A few weeks afterwards Carlisle and Nicholson decomposed water with it, and afterwards several salts. They were the first to use platinum electrodes. Davy, in the same year, traced the electricity of the pile to chemical action. Wollaston (1801) reiterated the same theory, and went the length of attributing even frictional electricity to chemical action. He proved likewise the identity of the two electricities, and showed that by diminishing the electrodes to mere points, the electricity of the machine could produce the same chemical effects as that of the pile. In 1803, Cruikshank improved the construction of the pile by disposing the plates horizontally in a trough instead of vertically in column. The main features of electro-chemical decomposition were discussed by Davy in his famous Bakerian lecture of 1806. In 1807, the same philosopher obtained, for the first time by galvanic agency, the metals potassium, sodium, barium, strontium, calcium, and magnesium. Deluc (1809) first made dry piles of gold and silver paper, and these were altered and improved by Zamboni (1812). In 1813, Davy discovered the electric light, and voltaic arc (see ELECTRIC LIGHT) by means of the colossal battery then placed at his disposal at the royal institution. Œrsted (1820) first observed the action of the current on the magnetic needle; and, a few months afterwards, Ampere discovered the law of this action, and originated an electric theory of magnets which has proved wonderfully fertile in practical results. In the same year Schweigger invented the galvanometer. In 1825, Becquerel, with the aid of his differential galvanometer, investigated the conductibility of metals. Kemp, in 1826, first used amalgamated zinc for the galvanic battery. In 1827, Ohm gave a mathematical theory of the pile, rigidly deduced from Volta's fundamental principle, and in perfect keeping with experiment. Faraday (1831–32) published his discoveries of the induction of electric currents, and of the evolution of electricity from magnets, which have since enriched the science with the induction coil (q.v.) and the magneto-electric machine (q.v.). This distinguished electrician discovered (1833–34) the definite nature of electro-chemical decomposition, and proved that electro-chemical and chemical equivalents were identical. In 1836, Daniell constructed his constant battery. Spenser in England, and Jacobi in Russia, made, simultaneously (1837), the discovery of electro-metallurgy. Grove (1839) constructed his nitric-acid battery. Faraday (1840) gave his proof of the truth of the chemical theory. Smee's battery dates also from this year. In 1843, Wheatstone, by means of his rheostat and resistance coils, investigated the resistances offered by various conducting substances to the current. In the same year Bunsen introduced his carbon battery.

The rivalry between the chemical and contact theorists has favored the advancement of the science, each party calling in the aid of experiment to support their views. Among the more distinguished contact theorists may be mentioned Volta, Ritter, Pfaff, Biot, Deluc, Ohm, and Fechner; and among the chemical theorists, Fabroni, Davy, Wollaston, Parrot, De La Rive, and Faraday. Davy latterly maintained a theory of distribution and equilibrium of electricity midway between the two, which numbered among its supporters Jæger, Berzelius, Ermann, and Prechtl. Recently (1860 onwards), sir William Thomson has given what he considers to be convincing proofs of Volta's contact theory, but he modifies the theory so far as to make it consistent with the conservation of force.

GALVANIC PAIR.—When two plates of copper and amalgamated zinc (zinc whose surface has been rubbed over with mercury) are placed in a vessel containing water to which a small quantity of sulphuric acid has been added, so long as they are kept from touching, either within or without the liquid, they remain apparently unaffected. If, however, they be made to touch, bubbles of hydrogen gas are formed in abundance at the copper plate, and their formation continues until the plates are again separated. If the contact be maintained for some time, and the plates and liquid be afterwards examined, it is found that the copper plate weighs exactly the same as before, that the zinc plate has lost in weight, and that the liquid cantains the lost zinc in solution in the form of the sulphate of that metal. The contact need not be affected by the plates themselves. If wires of copper, or any other conductor of electricity, be soldered to the plates, or fixed to them by binding screws, and be made to touch, the changes just mentioned take place as if the plates were in contact. When the wires are thus joined, and so to speak, form one connecting wire between the plates, they exhibit very peculiar properties. If a portion of the connecting wire be placed parallel to a magnetic needle, and the needle brought near, its north end no longer points to the north, but to a point either to the east or west of it, and this deviation ceases with the separation of the wires. It is not even necessary that the wires be in contact, for if their ends be put into a ves-

sel containing a conducting liquid, the same changes occur, though to a diminished extent, the contact being completed through the liquid. The ends of the wires, when so immersed, show strong chemical affinities. If the conducting liquid were a solution of the sulphate of copper, the wire from the zinc becomes coated with the copper of the solution whilst the other attracts its oxygen and sulphuric acid, and wastes away in entering into combination with them. The connecting wires are found, therefore, in actual or virtual combination, to possess very marked magnetic and chemical properties. The arrangement just described constitutes a *galvanic pair*, which may be generally defined to be *two dissimilar conducting plates immersed in a liquid which can act chemically on one of them, and capable of being placed in conducting connection;* and the properties just referred to, form the characteristic powers of galvanic electricity. These properties arise from the wires in connection being the seat of a constant discharge or flow of electricity, for they are possessed, though to a very feeble extent, by the electricity of the friction electric machine. If the prime conductor of a powerful electric machine (see ELECTRICITY) be connected with one of the binding screws of an insulated galvanometer, and a wire connected with the ground be fixed into the other, the plate on being turned causes a current of electricity to pass from the machine to the ground through the coil of the galvanometer, the needle of which will then show a deviation of one or two degrees. The deviation, so far as direction is concerned, is the same as that which would be produced by placing the wires coming from the copper and zinc respectively in the same binding screws as those connected with the machine and the ground. This would indicate that the copper plate stands electrically in the same relation to the zinc plate as the prime conductor of the machine to the ground. The electricity of the conductor is positive, and that of the ground by induction negative; so that in the galvanic pair the copper plate, by analogy, gives off positive electricity, and the zinc plate negative. Again, let the wire from the machine end in an insulated vessel containing a solution of the sulphate of copper, and let the end of a fine platinum wire connected with the ground be made to dip below the surface of the solution, and let the machine be kept in action so as to send a current of electricity through the wires and liquid, at the end of some minutes the point of the platinum wire will be covered with a minute quantity of copper. The wire connected with the zinc in the galvanic pair and that connected with the ground, are thus shown to display the same chemical power; and this, again, shows us that the zinc plate, like the ground in the above experiment, is the seat of negative electricity. The electric condition of the plates before contact reveals, with the aid of a delicate electrometer, positive electricity in the copper plate and negative in the zinc plate. If the wire joined to the zinc plate, or as we may write it shortly, zinc wire (not, however, necessarily a zinc wire), be connected with the ground, and the insulated copper wire be made to touch the lower plate of a condenser whilst the finger touches the upper, on both being withdrawn, the leaves of the electroscope diverge with the positive electricity sent to it from the copper plate. It can be shown, moreover, that the current is not confined to the connecting wire, for if a magnetic needle be suspended between the plates when they lie north and south, slightly above the surface of the liquid, it will deviate from its usual position when the wires are joined, and in the opposite way to that which it shows when held above the wire placed in the same direction. The current thus passes within the liquid from the zinc to the copper the opposite way to that in which it runs in the connecting wires, so that it makes a complete circuit. Hence we may conclude, generally, that *in the galvanic pair a current of electricity runs within the liquid from the chemically active to the chemically passive plate, and without the liquid, from the chemically passive to the chemically active plate, making a complete circuit;* and that if the connection be interrupted the pair shows electric polarity, the *chemically passive plate being the positive pole, and the chemically active plate the negative pole.*

The theory of the action of the galvanic pair may be thus given. When the two plates are put into the water and sulphuric acid, they assume opposite electric states. There is developed at the surface of the zinc an electric force arising from its affinity for the oxygen of the water, which throws the whole arrangement into a state of polarity. The zinc plate with its wire becomes polarized, showing negative electricity at the extremity furthest from the liquid, and positive electricity at the extremity next the liquid. The copper plate with its wire is polarized in the opposite way, being positive at its outer end, and negative at its end next the liquid. The compound molecules of water (H_2O), consisting of oxygen (O) and hydrogen (H_2), are likewise polarized, but the polarization takes place in the individual molecules. It appears, moreover, to have reference to their compound nature, and we may imagine them placed in series, with their oxygen or negative pole toward the zinc, and their hydrogen or positive pole toward the copper. When the ends of the wires are brought near each other, we might anticipate that a spark discharge would restore quiescence. This, however, is not the case, for the electric tension is so low that nothing short of contact can effect a discharge. When the discharge thus takes place, the polarity of the circuit for the instant ceases; the tendency to union of the zinc with the atom of oxygen next it is completed by the formation of the oxide of zinc. But in order to accomplish this, the hydrogen of the molecule of water next the zinc thus set free unites with the oxygen of the neighboring molecule to re-form water, and the same transference and union is continued along the whole series until the hydrogen of the molecule next the

copper is thrown on the copper, where, being unable to unite chemically with it, it is given off as a gas. From the fact that pure water has almost no action on zinc, a more probable hypothesis is held that it is not the water, but the sulphuric acid (H_2,SO_4) that is concerned in the action. We have H_2 as before; but instead of O, we have SO_4, a compound molecule forming zincic sulphate (Zn_2SO_4) at once. In either case the zinc is left clean, either by the acid dissolving the oxide, or the water present dissolving the sulphate. After the first discharge, therefore, the whole is as at first, so that a second discharge instantly follows, then a third, and so on. A series of discharges is thus transmitted through the circuit, constituting what is termed a current.

Nature of the Galvanic Circuit.—In a wire where a current of galvanic or frictional electricity is passing, there is no point which forms the seat of positive or negative electricity, but it appears electrically homogeneous throughout. It exerts no statical inductive action on surrounding objects, neither attracting nor repelling them, for the electric action being more easily propagated along the wire than in any other direction, takes place only in it. The laws of induction and distribution applicable to frictional statical electricity hold true in current electricity only at the section of the wire or conductor along which the action is transmitted. As tested by the magnetic needle, there is no part of the circuit which possesses more power than another. This homogeneity gives rise to the hypothesis, that every molecule of the circuit, whether solid or liquid, acts in the transmission of the electric force, and is similarly affected in its passage. In this way the plates and connecting wires show the same molecular polarity as the liquid, only the discharge does not effect an interchange among the molecules, but leaves them in the same condition as before. Each molecule of the connecting wire may be viewed to be the seat of electric polarity and discharge with its negative faces turned towards the copper, and its positive towards the zinc; whenever, therefore, we go with the current, we meet each molecule on its negative side, and whenever we go contrary to the current, we meet each molecule on its positive side. Any portion of the circuit shows its negative face to the approaching current, and its positive face at the other extremity. A break in the connecting wire thus separates two contiguous molecules; that ending the copper wire shows itself positive, and that ending the zinc wire negative. This is in perfect keeping with experiment, for wherever a break or change of medium is made in the circuit without stopping the current—as in the electric light, chemical decompositions, the visible passage of electricity in vacuous tubes, and the like—the ends or poles exhibit opposite powers, from the pole meeting the current discharging negative, and the other positive electricity. The polarity displayed at such interruptions, or visible passages of the current, is necessarily different from the polarity of frictional electricity, for the dynamical manifestation of electric force cannot be the same as the statical; in the same way that motion, for instance, the dynamical manifestation of the force of gravity is essentially different from weight, its statical manifestation. Within the galvanic pair itself the same polarity is shown; the zinc plate, without the liquid or the wire connected with it, is found to act as a negative pole, and the similar copper plate and wire as a positive pole; but within the liquid of the cell, the zinc plate shows the same chemical affinities as the exterior positive pole, and the similar copper plate acts as the exterior negative pole. The terms positive and negative poles are merely relative, for every molecule or series of molecules would thus appear to have its opposite poles. They serve, however, conveniently to express the relations of two consecutive parts of the circuit. Considerable confusion sometimes arises from speaking of the zinc plate as at once the positive element and negative pole, and the copper the negative element and positive pole of the galvanic pair, and such expressions seem even inconsistent. The truth is, that the zinc and copper plates must have each both poles from the very nature of the circuit; but as the outer poles only of these plates are of practical importance, these are considered to be the poles.

According to the one-fluid theory of electricity, a force is developed at the seat of the action, which has the power of liberating the electric fluid, and of maintaining it in motion throughout the circuit, constituting a current in the true sense of the term. According to the two-fluid theory, two such currents, one of the positive the other of the negative fluid, are made to move in opposite directions throughout the circuit. The propelling force is consequently termed *electro-motive*, and the galvanic pair is called the *electromotor*. The terms current and electro-motive have their origin in the supposed fluidity of electricity, but being quite definite in their application, they may be used without any such admission. A current may be taken to signify, apart from all supposition, simply the peculiar electric condition of the conductor, which forms the line of discharge between a positive and a negative source of electricity, and electro-motive force may be used simply to denote that which propagates and maintains this discharge. In the same way, when we speak of the direction of the current, we only use a convenient way of showing at which end the positive and negative electricities arise, the current being always represented as moving from the positive to the negative. The greater the electro-motive force is, the more powerfully is the discharge effected, and the more is it able to force its way through imperfect conductors.

Origin of Galvanic Electricity.—It would seem probable that the source of the electromotive force in the galvanic pair is the chemical action which takes place at the zinc plate. It must appear, even to the most cursory observer, highly probable that the

seat of the most active change going forward in the pair is likewise the origin of the force accompanying it. It is found, moreover, when we tax the galvanic current with electro-chemical work, that the amount of work done by it is exactly proportionate to the quantity of zinc dissolved. These and similar considerations seem to argue strongly that galvanic action has its source in chemical action. Volta, however, and several of the most eminent authorities in the science, maintain that the electro-motive force has its seat at the surface of contact of heterogeneous metals, and that chemical action is not the cause, but the manifestation of it. This view of the origin of galvanic electricity is called the *contact theory*, as distinguished from the *chemical theory*, the one we have hitherto followed. The contact theory supposes that at the surfaces of contact of two heterogeneous substances, an electro-motive force, invariable in direction and amount, is generated and subject to modification only by the resistance offered by the conducting circuit. The galvanic pair is accounted for by this theory in the following way. Let us suppose, for the sake of explanation, that both zinc and copper plates are connected by copper wires. The seat of electro-motive force is at the junction of the copper wire with the zinc. At this point the two metals assume opposite electricities—the copper the negative, and the zinc the positive; and since a conducting circuit through wires, plates, and liquid is established, these electricities travel in opposite directions, and, meeting, neutralize each other within the liquid, to give place to succeeding similar discharges of electricity. The discharge within the liquid takes place electrolytically. The theory is, in this case, sufficient and consistent, but it must be kept in mind, that in a circuit so perfectly homogeneous, the source of force may be placed anywhere without altering its conditions. It is, however, so far wrong in assuming that the contact of the metals, where there is no force lost or transformed, maintains a never-failing development of energy in the circuit—that, in fact, force can be created from nothing. Sir William Thomson and the modern advocates of the contact theory modify Volta's theory in this way. They admit with Volta that the contact of the metals charges them with different electricities, but that the chemical energy of the liquid in contact with the metals is necessary to discharge them and maintain the current. Sir William Thomson founds his belief of the truth of Volta's principle on an experiment like the following: A light bar of metal, AB (Fig. 1), is movable round A in the center of the compound metal ring, CZ, consisting of a semicircular band of copper, C, soldered to a like band of zinc. AB, when unchanged, lies in the line joining the junctions of the metals. When AB receives a small positive charge, it turns to the copper; if a negative charge to the zinc. Here, then, it is argued that contact produces a difference of tension or potential in the metals. It is necessary, however, to the success of the experiment, which is, at the best, an excessively delicate one, that the zinc be bright and clear, and the copper acts more effectually when coated with a thin film of oxide. It is therefore perfectly possible that, since the contact of the metals with the air is of such importance, it is there the action really lies, and that the ring is a chemical pair plunged in air instead of water. It is well known, indeed, that such a ring oxidizes in air as it does in water, only more slowly. Faraday mentions the following in proof of the chemical theory of the galvanic pair: Let (Fig. 2) A and B be two glass vessels containing sulphuret of potassium. Two platinum plates, P and P′, are put into the vessel A, and an iron plate F, with a platinum plate P″ in B. To the platinum plate P′ a platinum wire p, and to the iron plate F an iron wire f, are attached. From P and P″, wires proceed to the galvanometer G. The sulphuret of potassium is, for a liquid, a good conductor of electricity, but is chemically inactive when associated with platinum and iron in a circuit. When the wires p and f are joined, if an electro-motive force were developed at their surface of contact, all the conditions necessary for a circuit being present, a current would be generated, which would deflect the needle of the galvanometer. This last, however, gives not the slightest evidence of a current. If zinc be interposed at the junction of p and f, the galvanometer is equally unaffected; but if a piece of paper moistened with sulphuric acid be placed between the ends of these wires, a decided deflection ensues, and the iron becomes the positive element of a platinum-iron pair. We have thus conclusive evidence that the simple contact of the iron and the platinum is unattended by electro-motive force, and that this is developed only by the chemical action upon the iron of an interposed liquid. Again, into one of the vessels just referred to, let two plates, one of copper, the other of silver, be placed, and let communication be established between them and the galvanometer. The needle at first deflects briskly in a direction which shows that copper is the positive element of the pair, it then gradually returns to its first position, and again deflects in the opposite direction; showing that the silver is now the positive element. After some time it returns, and again deflects

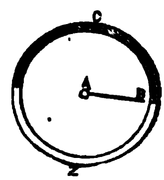


Fig. 1.

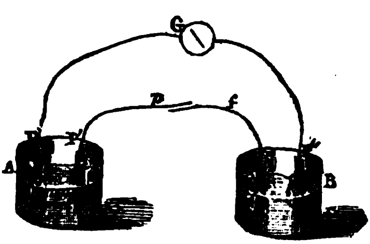


Fig. 2.

in the original direction, and goes on thus changing. If the plates be examined during these changes, it is observed that sulphuret of copper is formed when the copper is positive, and sulphuret of silver when the silver is positive; the alternate action being attributable to the relative condition of the plates when coated with their sulphurets. The electro-motive force of a silver copper pair is thus shown to be not invariable in direction as the contact theorists maintain; but to change its direction with the seat of chemical action.

Chemical conditions of the Galvanic Pair.—We have hitherto supposed that, in the galvanic pair, the zinc alone had affinity for the oxygen of the water, but chemistry teaches us that copper likewise has the same affinity, though to a less degree. Hence we must conclude that there originates at the copper an electro-motive force acting contrary to that of the zinc; and that the electro-motive force of the pair is the difference of these opposing forces. Were we to take two similar plates of zinc, instead of one of zinc and the other of copper, we should thus have two equal forces tending to propel two equal currents in opposite directions. In this case the two forces would equilibrate each other, and electrical and chemical inaction would be the consequence, a conclusion quite in keeping with experiment. It therefore becomes necessary to couple the zinc with a metal such as copper, less oxidable than itself. In keeping with this theory, it is found that if the zinc be coupled with a metal less oxidable still than copper, the resultant electro-motive force is increased. A pair consisting of zinc and silver gives an electricity of higher tension, and consequently a more powerful current than one of zinc and copper, and one of zinc and platinum a stronger current still; silver being less oxidable than copper, and platinum less than silver. As zinc forms the principal element of expense in maintaining the current, a platinum-zinc pair is more economical than either of the other two just named, because, for the same quantity of zinc dissolved, it gives the best electrical result. The greater, then, the disparity in oxidability, or in liability to be affected by the exciting liquid of the metals of the pair, the greater is its power.

In the galvanic cell we have found that not only the metals, but likewise the elements of the liquid, act as if they assumed opposite electricities. The zinc is positive with reference to the copper, and the hydrogen stands in the same relation to the oxygen. In the "electro-chemical order of the elements" (q.v.), the elements are approximately arranged according to the part they would play if associated in a galvanic pair, beginning with potassium, the most electro-positive,* and ending with oxygen, the most electro-negative; each being positive to the one succeeding, and negative to the one preceding it. Chemically speaking, electro-positive has much the same meaning as oxidable. We may here repeat the more common elements in the same order: Potassium, sodium, magnesium, zinc, iron, lead, copper, silver, platinum, hydrogen, carbon, chlorine, sulphur, oxygen. If it were proposed to ascertain from this list the action of a platinum-iron pair immersed in a solution of hydrochloric acid (HCl), we should proceed to argue thus: Iron, preceding platinum, is positive in relation to it. Chlorine succeeds hydrogen, and is relatively negative. Chlorine, the negative element of the liquid, would accordingly be discharged at the electro-positive iron, and the ferrous chloride (FeCl) would be formed. The electro-positive hydrogen would be disengaged at the electro-negative platinum. The interpolar current, consequently, proceeds from the platinum to the iron. If, however, no chemical affinity existed between iron and chlorine, no electricity would be generated, as chemical is essential to galvanic action. From such a list alone we cannot predict the result of any supposed combination. The metals themselves, as we have already seen, frequently change their relative positions, according to the action of the liquid in which they are put, so that the order given is by no means absolute. The electro-negative plate remains in presence of the electro positive totally unaffected, and more so than if it were placed by itself in the exciting liquid. Hydrochloric acid, for instance, readily attacks iron; but if a piece of zinc be put into the liquid, and be made to touch it, the iron will remain untouched until the zinc has been first dissolved. Wherever, therefore, iron is exposed to corrosive action, it may be protected from it by coupling it with zinc. This accounts, in some degree, for the durability of iron coated with zinc, or, as it is called, "galvanized iron" (q.v.). In the same way zinc protects copper from corrosive action. On the other hand, zinc corrodes more readily in presence of these metals, and hence the necessity for using zinc nails for zinc roofs instead of iron or copper nails. When pure zinc is put into dilute sulphuric acid, almost no change is visible, whilst ordinary commercial zinc is rapidly dissolved by it. This arises, in all probability, from different portions of the latter standing in different chemical relations, arising from the heterogeneous structure introduced by extraneous substances. Galvanic pairs are thus established within the metal, and the metal dissolves in consequence. In a designed galvanic pair, *local* circuits would thus be formed at different parts of the zinc plate, which, besides occasioning a useless waste of the metal, would lessen the strength of the main circuit, were it not found that amalgamated zinc possesses the properties of the pure metal.

The Current Elements.—In the action of the pair, three elements are to be considered —the *electro-motive force*, the *resistance*, and the *strength of the current*. The electro-

* According to Bunsen, the new metal, caesium, is the most electro-positive substance yet known.

motive force is proportional to the force, tending to chemical action if we adopt the chemical theory, or, on the contact theory, to difference of potential produced by the contact of the two metals. It is measured directly by the charge, or, as it is called, the potential (tension) which a cell gives to a delicate electrometer. In Thomson's reflecting quadrant electrometer, for instance, a single Daniell's cell deflects the needle so much, that the spot of light moves some 2½ in. from the zero-point of the scale. The relative electro-motive powers of the various forms of cells can be ascertained by the amount of deflection indicated by such an instrument. The resistance in the circuit which is offered by the liquid of the cell and the interpolar wire or other connection, is that which tends to reduce the current or flow of electricity produced by the electro-motive force. As stated in Ohm's law, the current strength is equal to the electro-motive force divided by the resistance. The electro-motive forces of the different cells can also be compared by observing the effect, on the current strength, of a given resistance interposed in the relative circuits, whose own proper resistance has been previously known.

Units of the Current Elements.—The unit of electro-motive force now adopted by British electricians is called a *volt.* This is about 7 per cent less than that of a Daniell's cell. The unit of resistance is called an *ohm* or B.A. unit. 485 meters of pure copper wire 1 millimeter in diameter offer an ohm of resistance; so does about $\frac{1}{13}$ of a mile of ordinary telegraphic wire (No. 8). The unit of current strength is called a *farad*, and is the amount of flow of electricity that would be produced in a second if a cell of a volt in power were to act in a circuit of an ohm of resistance. One million volts are called a megavolt; one-millionth of a volt, a microvolt. The same proportion holds for a megohm and a microhm, a megafarad and a microfarad. In the centimeter, gram, second series of electro-magnetic units, an ohm is expressed as 10^9, a farad as 10^{-1}, and a volt as 10^8.

GALVANIC BATTERY.—When a number of copper and zinc pairs, similar to the one already referred to, are put together, so that the copper plate of one cell is placed in conducting connection with the zinc plate of the next, they constitute a galvanic battery. The term battery is sometimes also applied to a number of cells acting as one combination, in whatever way they may be connected. When the terminal copper and zinc plates are connected, the current runs from each copper to each zinc plate without the liquids, and from each zinc to each copper plate within the liquids; and when the contact is broken, the zinc pole shows negative, and the copper pole positive, electricity. The galvanic battery acts thus in all respects as a compound galvanic pair. If the polar wires be connected with a tangent galvanometer, the deflection of the needle caused by the battery will be exactly the same as that effected by one of the cells, provided the wire be thick, and a good conductor; but if the zinc end be connected with the ground, and the electric tension of the insulated copper pole be tested by a condenser and torsion balance, its tension is found to be as many times greater than the tension of the same pole of one cell examined in the same way, as there are cells in the combination. Thus, if two cells be taken, the tension is doubled; if three, tripled; and so on. *The electro-motive force of a battery is therefore proportional to the number of cells,* supposing, of course, that they are arranged consecutively. Hence the electricity of a battery is better able to force its way through imperfect conductors than that of the simple pair. When the interpolar communication is formed by a thick short wire, a single cell produces as powerful an effect on the magnetic needle as a battery; but if it be formed by a bad conductor, such as a long and thin wire, or a liquid, the effect is very different. The current of the pair is then nearly stopped, and its influence on the needle small, while that of the battery continues to flow comparatively unimpaired. When a battery is put up in series, it is said to have a tension arrangement; when put up so that several of the cells are grouped together, so as to act as one large cell, it is said to have a tension arrangement. Thus 20 cells are arranged for tension when joined in succession; but they may be disposed so as to act as one large cell 20 times as large, or as 10 cells twice as large, or as 5 cells four times as large, and so on. The disposition or size of the cells is determined from the circuit.

Different Forms of the Galvanic Battery.—*Volta's pile* consists of a number of circular plates, each made up of a plate of copper and a plate of zinc soldered together, built up, the copper plates facing one way, and the zinc the other, each compound plate being separated by a circular piece of woolen cloth, moistened with a solution of common salt, or dilute sulphuric acid. In consequence of the great number of pairs, the electric tension of the poles of Volta's pile is considerable. One furnished with from 60 to 100 plates can charge an electroscope without the condensing plates. It is from this battery that the term "pile" is applied to the galvanic or voltaic battery. Volta used another form of battery, which he called *a crown of cups.* This consisted of a number of cells arranged in a circle, so that the first and last were contiguous.

Zamboni's Dry Pile consists of several hundreds, and sometimes thousands, of disks of paper tinned on one side, and covered with binoxide of manganese on the other, put together consecutively, as in Volta's pile, and placed under pressure in an insulating glass tube closed with brass ends, which serve as the poles. The electric tension of the poles of this arrangement is considerable, but the strength of the current which passes when the poles are joined, is next to nothing. The most important application of the

dry pile is in the construction of a very delicate electrometer, which is named after its inventor, *Bohenenberger's electrometer*.

The Galvanic Trough, introduced by Cruikshank, is a trough into which rectangular plates of copper and zinc, like those of Volta's pile, are fixed, the cells included between each pair being filled with dilute sulphuric acid. The inner surface of the trough is coated with an insulating substance.

Wollaston's Battery.—Each couple of this battery is made up of a plate of copper, doubled up so as to include a plate of zinc, from which it is kept apart by strips of wood. Both faces of the zinc are thus equally exposed to chemical and galvanic action, a device by which the quantity of electricity is increased. In such a battery the connecting strips of metal are fixed on a wooden rod, which allows of them being lifted or lowered together. When the battery is put in action, the whole is lowered, and the couples are immersed each in a trough filled with dilute sulphuric acid (1 of the acid to 12 of water). When out of action, the whole is lifted and fixed by binding screws to the supporting pillars. When the number of pairs is small it is of little consequence whether one large trough or a number of small ones be used.

Smee's Battery.—In Smee's conple, the position of the plates of Wollaston's couple is reversed. It consists of a silver plate, with a zinc plate on either side, kept separated from it by slips of wood, the two zinc plates being fastened by a coupling. There are thus two positive plates to one negative, instead of two negative to one positive, as in Wollaston's couple, and this is found to increase still more the strength of the current produced. The silver plate is platinized—that is, covered over with finely divided platinum—and this is found to lessen the adhesion of the hydrogen bubbles to the plate, thereby greatly improving the constancy of the action. Smee's battery has the same arrangement as Wollaston's.

Grove's Gas Battery.—This battery is more intended for instruction than use. Into the two outer necks of a three-necked bottle, two glass tubes are fitted by means of corks through which they pass. Each of these tubes is open below, and a platinum wire enters them hermetically above, to which a long strip of platinum is soldered, extendnig nearly to the bottom of the tube. Little cups containing mercury stand at the upper ends of these wires. The whole apparatus is filled with slightly acid water, and the poles of a galvanic battery are placed in the little cups. Water is thereby decomposed: oxygen forms in the one tube and hydrogen in the other. When the battery wires are removed, no change takes place till metallic connection is established between the cups, and the oxygen and hydrogen gradually disappear, attended by an electric current which passes from the oxygen to the hydrogen. When several of these are put together in a battery, the connection being always oxygen to hydrogen, they can decompose water. The most important fact illustrated by Grove's battery is, that the oxygen and hydrogen, liberated by galvanic agency, when left to themselves, produce a currrent the opposite to that which separated them. When the poles of the decomposing battery were in the mercury cups, hydrogen is given off at the negative, and oxygen at the positive pole; and as opposite electricities attract, it is manifest that the hydrogen in this action is positive, and the oxygen negative. When the two gases form, by means of the platinum plates, a galvanic pair by themselves, the current must proceed, as in all cases, from the positive to the negative within the liquid, and the reverse way between the poles; but this is the opposite of the direction of the original current. It is therefore manifest that where oxygen or hydrogen is set free at any point in a galvanic circuit, they will tend to send a counter-current. This action is called *galvanic polarization*. This accounts for the sudden falling off of strength in all galvanic couples where hydrogen is set free at the negative plate. The bubbles of the gas adhering to the plate, not only lessen the surface of contact between the plate and the liquid, but exert an electromotive force contrary to that of the pair, and this goes on increasing until the action becomes greatly reduced. In all improved forms of the pair, it therefore becomes necessary to adopt some means for preventing the disengagement of hydrogen at the negative plate, and this is done in all *constant batteries* by employing two fluids instead of *one*. The best known constant batteries are those of Daniell, Grove, and Bunsen.

Daniell's Battery.—The containing vessel of the Daniell cell is of copper, which serves likewise as the negative element of the pair. Inside of this is another vessel of porous unglazed earthenware containing a rod of zinc. The space between the copper and the porous cell is filled with a solution of the sulphate of copper, which is kept concentrated by crystals of the salt lying on a projecting shelf, near the surface of the solution, and dilute sulphuric acid is placed with the zinc in the porous cell. When a tangent galvanometer is included in the circuit, the needle keeps steadily at the same point for hours. The rationale of its action is given as follows: the porous cell which keeps the fluids from mingling, does not hinder the passage of the current; when the atoms of hydrogen that would ultimately be freed at the copper reach the porous cell, they displace the copper in the sulphate of copper, and copper instead of hydrogen is thrown on the copper plate. To give a graphic representation of this action, it is necessary to suppose that the sulphate of copper is $CuSO_4$, the direct combination of the metal (Cu) with a salt radical (SO_4) called sulphion, and that the dissolution of the zinc arises from the decomposition of sulphuric acid, regarded as the sulphionide of hydro-

gen (H_2SO_4), the SO_4 directly attacking the metal. This view of the composition of oxygen salts, though new in Daniell's time, is now universally admitted. Taking these letters to represent the molecules, and beginning with the copper (Cu) of the outer vessel, and ending with the zinc (Zn) of the rod, we have the arrangement before discharge, $Cu,\overline{CuSO_4},\overline{CuSO_4},|^{d}H,SO_4\ \overline{H,SO_4}\ Zn$; and after it, $\overline{CuCu}\ \overline{SO_4Cu}\ SO_4|^{d}H\ \overline{SO_4,H}\ \overline{SO_4Zn}$. The discharge, therefore, effects a deposition of copper at the copper, and the formation of sulphionide of hydrogen at the porous cell, and of sulphionide of zinc at the zinc rod. Instead of hydrogen in its nascent state being deposited at the copper, we have copper in the same condition; but the galvanic polarization caused by the latter is very much inferior to that resulting from the former, and hence the superior electro-motive force of Daniell's cell. The porous cell keeps the sulphate of zinc from reaching the copper, and thus obviates another source of diminished force in the one-fluid battery. The sulphate of zinc once formed, is itself subjected to the decomposing action of the pile, and zinc is deposited on the copper-plate, thus tending to give a zinc-zinc instead of a copper-zinc pair. The constancy of Daniell's battery is not unlimited, for the sulphate of zinc which results from the action, being a bad conductor of electricity, enfeebles the current. In the Daniell cell used for telegraphs, the containing vessel is of glass, and no sulphuric acid is added to the water round the zinc, as, in the course of the action, sufficient acid comes through from the sulphate cell.

Grove's Battery consists of platinum-zinc couples. Fig. 3 shows an excellent arrangement of a cell of it. The outer cell of glass, *g*, is filled with dilute sulphuric acid (1 part of acid to 8 of water), in which a cylindrical plate of zinc, *z*, is immersed. Inside the zinc is a porous cell, *d*, containing concentrated nitric acid and the platinum plate, *p*, which is bent into the form of an S (fig. 4), to increase its surface. Grove's couple is very much superior in power to any of the preceding, though it is inferior in constancy to Daniell's. When the poles are joined, sulphate of zinc is formed in the outer cells and hyponitric acid (NO_4) vapors are given off by the nitric acid. As these vapors are injurious to the health when breathed for any time, the porous cell is closed with a stopper of wood, to prevent or lessen their escape, the connection between the exterior and the platinum plate being made by a strip of metal passing through the wood. The chemical action of Grove's couple may be shown as before, taking nitric anhydride (N_2O_5) to be the oxide of nitric peroxide (N_2O_4). Before discharge, the molecules stand thus, beginning with the platinum: $Pt,\overline{N_2O_4O},\ \overline{N_2O_4O},\ |^{d}H_2SO_4,\ H_2SO_4,Zn$: and after it, $Pt,N_2O_4,\ \overline{ON_2O_4},\ \overline{O|^{d}H_2},\ \overline{SO_4H_2},\ SO_4Zn$. The nitric peroxide ($N_2O_4$) discharged at the platinum plate is absorbed by the nitric acid, in which it is soluble, so that the plate is left free. The cells of a Grove's battery are connected with the platinum of the one to the zinc of the other.

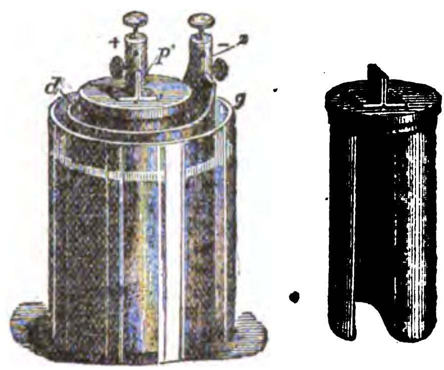


FIG. 4.

Bunsen's Battery.—Bunsen's cell has the same chemical action as Grove's, the platinum being replaced by carbon. There are two forms of the cell—the one invented and employed by prof. Bunsen, and generally adopted in Germany; and the modification introduced by Archerau, generally found in England and France. The Bunsen cell, properly so called, has a carbon cylinder immersed in nitric acid, and the porous cell zinc containing the zinc and sulphuric acid placed within it. In a battery of these cells, the of one cell is connected with the carbon of the next. In the second form, the same arrangement is adopted as in Grove's cell. The latter form of the Bunsen cell, in consequence of the preponderance of the positive surface, gives the greater quantity of electricity. For the manufacture of the Bunsen carbons, see CARBON FOR ELECTRIC PURPOSES. Bunsen's battery, in point of cheapness, is preferable to Grove's, where the platinum forms an expensive item, but is inferior to it in point of compactness. In these couples, the platinum and carbon may be replaced by iron, which is nearly as electro-negative as either in concentrated nitric acid. The electro-motive forces of the various cells expressed in volts, are Grove's, 1.92; Bunsen's, 1.88; Daniell's, 1.079; Smee's, 0.47; and Wollaston's, 0.39. The resistance in Daniell's cell is much greater than in Grove's or Bunsen's.

Different Forms of the Zinc-carbon Battery.—Marié Davy Cell: This cell is used extensively on French telegraphic lines with the best results. It is much smaller in size than the smallest Daniell cell, the containing glass vessel being little more than 3 inches in height. It has been found that 38 elements do as much as 60 couples of Daniell, and

keep in action twice as long, requiring no replenishing for half a year. The chemical action is much the same as that of Daniell's. The cell is thus charged; powdered mercurous sulphate, Hg_2SO_4, is treated with water, a basic insoluble salt is formed, and falls to the bottom of the vessel, but a small amount of a mercurous salt is left dissolved in the water. The clear liquid is decanted off and a paste is left. The carbon is placed in the porous cell, and the vacant space is filled with the paste thus got. The glass vessel outside containing the zinc is charged with pure water and a little of the decanted liquid. The connections are made by straps of lead instead of copper, to avoid the action of the mercurous salt on the latter metal. The small quantity of mercurous salt in the zinc cell has the excellent effect of keeping the zinc constantly amalgamated.—*Bunsen's Bichromate Cell:* Bunsen sometimes charges his cells with a liquid consisting of from 100 to 150 parts, by weight, of water, to which 12 parts of bichromate of potash and 25 parts of sulphuric acid have been added. No porous cell is needed with this charge. the carbon being kept from touching the zinc by hempen cords or the like.—The *Bichromate Cell,* as generally used in this country, is thus made up. The liquid with the carbon in the porous cell is in the proportion of 10 oz. of water to 1 oz. of bichromate of potash and 5 oz. of sulphuric acid. In Bunsen's bichromate charge, zincic sulphate is formed and potassium chrome alum. In the last-named bichromate cell, zincic chloride is formed in the zinc cell, and potassic and sodic chrome alum in the porous cell.

GALVANOMETERS.—The two most reliable evidences of the strength of the galvanic current are its power to deflect the magnetic needle, and to effect chemical decomposition. To measure one or other of these, is the object of a galvanometer or voltameter. A magnetic galvanometer shows the strength of the current by the amount of the deflection of the needle, and shows its direction by the way in which it deflects. The manner in which a needle should turn when influenced by a current is easily kept in mind by Ampere's rule: *Suppose the diminutive figure of a man to be placed in the circuit, so that the current shall enter by his feet, and leave by his head; when he looks with his face to the needle, its north pole always turns to his left.* The deflecting wire is supposed always to lie in the magnetic meridian. The *astatic galvanometer*, or *galvanometer*, is used either simply as a galvanoscope, to discover the existence of a current, or as a measurer of the strengths of weak currents. When a needle is placed under a straight wire, through which a current passes, it deflects to a certain extent, and when the wire is bent, so as also to pass below the needle, it deflects still more. This is easily understood from the above rule. The supposed figure has to look down to the needle when in the upper wire, and to look up to it in the lower wire, so that his left hand is turned in different ways in the two positions. The current in the upper and the lower wire moves in opposite directions, thus changing in the same way as the figure; and the deflection caused by both wires is in the same direction. By thus doubling the wire, we double the deflecting force. If the wire. instead of making only one such circuit round the needle, were to make two, the force would be again doubled, and if several, the force (leaving out of account the weakening of the current caused by the additional wire) would be increased in proportion. If the circuits of the wire be so multiplied as to form a coil, this force would be enormously increased. Two needles, as nearly the same as possible, placed parallel to each other, with their poles in opposite ways and suspended, so as to move freely, by a thread without twist, have little tendency to place themselves in the magnetic meridian, for the one would move in a contrary direction to the other. If they were exactly of the same power, they would remain indifferently in any position. They cannot, however, be so accurately paired as this, so that they always take up a fixed position, arising from the one being somewhat stronger than the other. This position is sometimes in the magnetic meridian, sometimes not, according as the needles are less or more perfectly matched. Such a compound needle is called *astatic*, as it stands apart from the directing magnetic influence of the earth. If an astatic needle be placed in a coil, so that the lower needle be within the coil, and the upper one above it, its deflections will be more considerable than a simple needle, for two reasons: in the first place, the power which keeps the needle in its fixed position is small, and the needle is consequently more easily influenced; in the second place, the force of the coil is exerted in the same direction on two needles instead of one, for the upper needle being much nearer the upper part of the coil than the lower, is deflected alone by it, and the deflection is in the same direction as that of the lower needle. An astatic needle so placed in a coil constitutes an astatic galvanometer. Round an ivory bobbin, in one of these instruments, a coil of fine copper wire, carefully insulated with silk, is wound, its ends being connected with binding screws. The astatic needle is placed in the bobbin. which is provided with a vertical slit, to admit the lower needle, and a lateral slit, to allow of its oscillations, and is suspended by a cocoon thread to a hook supported by a brass frame. The upper needle moves on a graduated circle; the compound needle hangs freely, without touching the bobbin. The whole is included in a glass case, and rests on a stand, supported by three leveling screws. When used, the bobbin is turned round by a screw until the needle stands at the zero point, and the wires through which the current is sent are fixed to the binding screws. The number of degrees that the needle deflects may then be read off

The sensitive galvanometers, now fast taking the place of all others, are those designed

by sir William Thomson. In fig 5, which represents the dead-beat galvanometer, the general action of these is shown. C is a bobbin filled with fine covered wire set on a stand. In the tube A, which forms the center of the bobbin, a tubular box fits, in the middle of which hangs a circular mirror made of microscopic glass, slightly concave, suspended by a fine silk fiber. To the back of this mirror are stuck four fine magnetic needles. The mirror and needles weigh $\frac{1}{30}$ of a gram ($\frac{1}{2}$ grain). The fiber by which the mirror hangs is too feeble to give anything like a quick set to it. To accomplish this, a powerful magnet

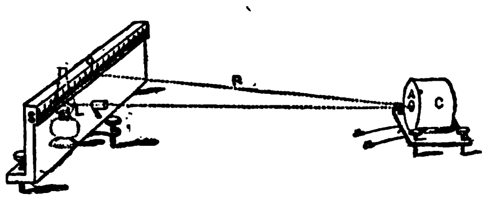


FIG. 5.

is laid outside the instrument, and placed so that the mirror lies in the way required for observation. About a meter in front of the mirror, a graduated scale, *ss*, is placed, and immediately below it a lamp, L. A pencil of light, I, is sent from L, and reflected (R) back to the scale, where it comes to a focus at the zero point. A slight deflection of the needles, caused by a current in the coil, makes a decided displacement in the spot of light on the scale. The compartment in which the mirror is hung is very limited in size. The glass before and behind is so close to the mirror as to allow it no more play than the small range the instrument requires, and the mirror, when at rest, just clears the sides of the box, and nothing more. In other galvanometers, the mass of the movable part, and its comparatively weak magnetism, make the indications of the needle tediously slow. In this instrument, the moving mass is small, and its magnetism comparatively great, and this, combined with the viscosity of the air in the narrow chamber and the powerful directive force of the external magnet, gives an immensely greater rapidity of indication, with even increased sensitiveness.

Tangent Galvanometer.—This instrument is shown in fig 6. It consists essentially of a thick strip of copper, bent into the form of a circle, from 1 to 2 ft. in diameter, with a small magnetic needle, moving on a graduated circle, at its center. When the needle is small compared with the ring, it may be assumed that the needle, in any direction it lies, holds the same relative position to the disturbing power of the ring. This being the case, it is easy to prove that *the strengths of currents circulating in the ring are proportionate to the tangents of the angles of deviation of the needle.* Thus, if the deflection caused by one galvanic couple was 45°, and of another 60°, the relative strengths of the currents sent by each would be as the tangent of 45° to the tangent of 60°—viz., as 1 to 1.73. The needle can never be deflected 90°, for as the tangent of 90° is infinitely large, the strength of the deviating current must be infinitely great, a strength manifestly unattainable. The tangent galvanometer can consequently be used to measure the strongest currents.

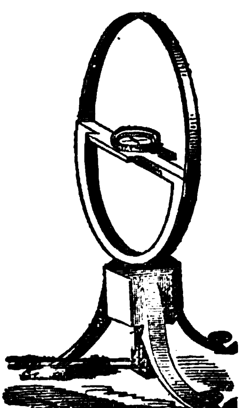


FIG. 6.

Voltameter.—This was invented by Faraday for testing the strength of a current. In this apparatus two platinum plates, each about half a square inch in size, are placed in a bottle containing water acidulated with sulphuric acid; the plates are soldered to wires which pass up through the cork of the bottle; binding screws are attached to the upper ends of these wires; a glass tube fixed into the cork serves to discharge the gas formed within. When the binding screws are connected with the poles of a battery, the water in the bottle begins to be decomposed, and hydrogen and oxygen rise to the surface. If, now, the outer end of the discharging tube be placed in a trough of mercury (mercury does not dissolve the gases), and a graduated tube, likewise filled with mercury, be placed over it, the combined gases rise into the tube, and *the quantity of gas given off in a given time measures the strength of the current.* The voltameter chooses as a test the work which the current can actually perform, and establishes a uniform standard of comparison. The indications of the tangent galvanometer are comparable only with its own, but the quantity of gas discharged by the voltameter, corrected for pressure and temperature is something quite absolute. However, by comparing the indications of both instruments with each other when placed in the same circuit, an absolute standard may likewise be got for the tangent galvanometer. If, for instance, the current given by a battery should give 60 cubic centimeters of gas in a minute, and produced at the same time a deflection of 45° in the galvanometer, the ratio of 60 to the tangent of 45°—viz., 60 to 1 = 60, is constant, for correct measurements of the strength of currents, however taken, must bear to each other a constant ratio. If the angle of deviation for another current was 30°, we have therefore only to multiply 60 by the tangent of 30°, to ascertain the amount of gas that would be liberated by a current of that strength in a minute. This found, we know the meaning of a deflection of 30° of the galvanome-

ter in question in a perfectly comparable standard. The plates of the voltameter must be small, for when they are large, a small quantity of electricity is found to pass without decomposing the water. It is found also that a minute quantity of the oxygen forms hydric peroxide with the water, and remains in solution, so that when very great accuracy is required, the hydrogen alone ought to be measured.

RESISTANCES TO THE CURRENT.—It is found that the dimensions and material of substances included in the circuit exercise an important influence on the strength of the current. It is of the greatest importance to ascertain the relative amount of the resistance offered by conductors of various forms and materials. The *rheostat*, invented by Wheatstone, is generally employed for this purpose, and for this object is constructed so as to introduce or withdraw a considerable amount of highly resisting wire from the circuit without stopping the current. It is shown in fig. 7. Two cylinders, C′, C, about 6 in. in length, and 1½ in. in diameter, are placed parallel to each other, both being movable round their axis. One of them, C′, is of brass, the other, C, is of well-dried wood. The wooden cylinder has a spiral groove cut into it, making forty turns to the inch, in which is placed a fine metallic wire. One end of the wire is fixed to a brass ring, which is seen in the figure at the further end of the wooden cylinder; and its other end is attached to the nearer end (not seen in the figure) of the brass cylinder, C′. The brass ring just mentioned is connected with the binding screw, S, by a strong metal spring. The further end of the cylinder C′, has a similar connection with the binding screw, S′. The key, H, fits the projecting staple of either cylinder, and can consequently turn both. As the brass cylinder, C, is turned in the same direction as the hands of a watch, it uncoils the wire from the wooden cylinder, C, making it thereby revolve in the same way. When the wooden cylinder is turned contrary to the hands of a watch, the reverse takes place. The number of revolutions is shown by a scale placed between the two, and the fraction of a revolution is shown by a pointer moving on the graduated circle, P. When the binding screws, S and S′, are included within a circuit, say S with the positive, and S′ with the negative pole, the current passes along the wire, on the wooden cylinder, C, till it comes to the point where the wire crosses to the brass cylinder, C′; it then passes up the cylinder, C′, to the spring and binding screw, S′. The resistance it encounters within the rheostat is met only in wire, for as soon as it reaches the large cylinder, C′, the resistance it encounters up to S′ may be considered as nothing. When the rheostat is to be used, the whole of the wire is wound on the wooden cylinder, C, the binding screws are put into the circuit of a constant cell or battery along with a galvanometer, astatic or tangent. If, now, the resistances of two wires are to be tested, the galvanometer is read before the first is put in the circuit. After it is introduced, in consequence of the increased resistance offered by it, the needle falls back, and then as much of the rheostat wire is unwound as will bring the needle back to its former place. The quantity of wire thus uncoiled in the rheostat is shown by the scales, and is manifestly equal in resisting power to the introduced wire. The first is then removed, the rheostat readjusted, and the second wire included, and the same unwinding goes on as before. To fix our ideas, let the quantity of wire unwound in the first case be 40 in., and in the second case 60 in.; 40 in. of the rheostat wire offer as much resistance to the current as the first wire, and 60 in. of it as much as the second. We have thus 40 to 60 as the ratio of the resistances of the two wires. The wire of the rheostat, from its limited length, can only be comparable with small resistances; and where great resistances are to be measured, supplementary *resistance coils* of wires, of a known number of ohms, are introduced into the circuit, or removed from it, as occasion requires, leaving to the rheostat to give, as it were, only the fractional readings. This being premised, it will be easily understood how the following results have been ascertained. It is proved, for instance, that the *resistances of wires of the same material, and of uniform thickness, are in the direct ratio of their lengths, and in the inverse ratio of the squares of their diameters.* Thus a wire of a certain length offers twice the resistance of its half, thrice of its third, and so forth. Again, wires of the same metal, whose diameters stand in the ratio of 1, 2, 3, etc., offer resistances which stand to each other as 1, ¼, ⅑, etc.; therefore, the longer the wire the greater the resistance; the thicker the wire the less the resistance. The same holds true of liquids, but not with the same exactness. For this reason, the larger the plates of a galvanic pair, and the nearer they are placed to each other, the less will be the resistance offered to the current by the intervening liquid. The following table of the resistances, expressed in ohms, offered by a wire one meter long and one millimeter in diameter at 0° centigrade, has been determined by Dr. Mathiessen: Silver annealed, 0.01937; copper annealed, 0.02057; gold annealed, 0.02650; aluminum annealed, 0.03751; zinc, 0.07244; platinum annealed, 0.1166; iron annealed, 0.1251; tin, 0.1701; lead, 0.2526; mercury, 1.2247; German silver, 0.2695. With copper at 32° F. as 1, the following liquids stand thus: Saturated solution of the sulphate of copper, at 48° F., 16,885,520; ditto of chloride of sodium at 56° F., 2,903,538; sulphate of zinc; 15,861,267; sulphuric acid, diluted to $\frac{1}{12}$, at 68° F., 1,032,020;

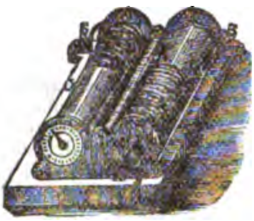


FIG. 7.

nitric acid, at 55° F., 976,000; distilled water, at 59° F., 6,754,208,000. The slightest admixture of a foreign metal alters the resistance very decidedly: ½ per cent of iron in copper wire increases the resistance more than 25 per cent. It has been found also that the resistance offered by a wire increases as its temperature rises. It is almost needless to add, that the conducting powers of metals are inversely as their specific resistances, the least resisting being the best conducting.

Ohm's Law.—This law is singularly in accordance with experimental results. It assumes that the electro-motive force for a particular galvanic pair is constant, and that the strength of the current it produces is the quotient which results from dividing it by the resistance of the circuit. This resistance arises from two sources, the first being the resistance within the cell offered by the exciting liquid, and the second the interpolar resistance. If e represent the electromotive force; l, the resistance within the cell; w, the interpolar resistance; and S, the strength of the current, or the quantity of electricity actually transmitted, the statement of the law for one couple stands thus $S := \frac{e}{l+w}$. The application of the law in a few particular cases will best illustrate its meaning. If we increase the number of cells to n, we increase the electromotive force n times, and at the same time we increase the liquid resistance n times, for the current has n times as much of it to travel, then $S = \frac{ne}{nl+w}$. If w be small compared with nl—that is, if the external connection be made by a short thick wire—it may be neglected, and so $S = \frac{ne}{nl} = \frac{e}{l}$. This shows that one cell gives in these circumstances as powerful a current as a large battery. But if nl be small with respect to w—as in the interpolar circuit of an electric-telegraph battery—nl may be neglected, and $S = \frac{ne}{w}$. Here we learn that the strength of the current increases directly as the number of cells. We may learn from the same that the introduction of the coil of long thin wire of a galvanometer into such a circuit, introducing but a comparatively small increase of resistance, causes a very slight diminution of the current strength. If, again, we increase the size of the plates of a galvanic pair n times, the section of the liquid is proportionately increased, so that whilst the electromotive force remains the same, the cell resistance diminishes n times; therefore $S = \frac{e}{\frac{l}{n}+w}$, or $S = \frac{ne}{l+nw}$. If the exterior resistance is small, nl may be neglected, and $S = \frac{ne}{l}$, and the strength is thus shown to increase n times. These are only a very few of the conclusions arrived at by this law. With the aid of a tangent galvanometer, which gives the value of S expressed in absolute magnetic units, or centimeters of voltameter gas, we ascertain e and l for any pair. By making two observations with two wires of known resistance separately included in the circuit, we have two simple equations with two unknown quantities, from which e and l can be easily found. In doing so we must adopt a *unit of resistance*. The unit proposed and determined by the British association, the B.A. unit, or the ohm, is the only one now used in this country. The resistance of the liquid of the pair would be expressed in units of this, and the electromotive force in absolute units or centimeters of gas, with a circuit offering a unit of resistance.

THE EFFECTS OF THE GALVANIC CURRENT may be classified under physiological, mechanical, magnetic, heating, luminous, and chemical. The mechanical effects relate to the mutual attraction or repulsion of one current to another, or to a part of itself. These, along with the magnetic effects, will be found treated of under MAGNETO ELECTRICITY. The heating and luminous effects have been partly discussed under ELECTRIC LIGHT. We shall here only further refer to the heating of wires, and to the galvanic spark. The luminous effects of galvanic electricity of very high tension will be given under INDUCTION COIL. The chemical effects have been already referred to, but a fuller consideration of these will now be given under the head Electrolysis in this article.

The physiological effects, as shown by the convulsions of Galvani's frog preparation, were the first observed manifestation of the current. Frog-limbs, as prepared by Galvani, when included in a circuit, form a galvanoscope of excessive sensibility, which rivals the finest galvanometer in delicacy of indication. There is one peculiarity in their action which deserves to be noted. The limbs contract only when the circuit is completed and broken, and remain undisturbed so long as the current passes steadily through them. The more frequently, therefore, the current is stopped and renewed, the greater is the physiological effect. The same is experienced when a current is passed through the human body. When the terminal wires of a battery are lifted one by each hand, except it consist of a very large number of cells, almost the only sensation felt is a slight shock on completing and breaking the circuit. Du Bois Reymond, the great authority on animal electricity, states that the nerves of motion are affected only by changes in the electric tension of the current, whereas the nerves of sensation

are affected not only by these, but also by the steady continuance of the current, and that the excitation of the nerves dependent on the changes of tension increases with their frequency and suddenness. Frictional electricity in this way owes its superior physiological power to the instantaneous nature of its discharge. It is only currents of great tension which affect the ordinary human nerves. The poles of a battery of 50 Bunsen cells, capable of giving a brilliant electric light, for instance, may be handled without much inconvenience. This may be attributed partly to the non-conducting nature of the skin. If the current enter the body by a cut or wound, the sensation is affected even when the current is weak. The physiological effect is also much heightened by moistening the hands with salt and water, or by holding metal handles instead of wires, so as to improve the conducting connection. Another cause of this insensibility may be attributed to the fact that the current is not restricted, as it is in part of the frog preparation, to the nerve, but passes through all the conductors of the system. The nerves of the palate can be affected by a very feeble current; that of sight by one proceeding from a battery of one or two cells, and that of hearing by a battery of some 30 cells. See ELECTRICITY, MEDICAL.

Heating Effects.—When a strong current passes through thin wires, an intense heat is produced, sufficient to bring them to a white heat, and to fuse them. This is turned to practical use in exploding gunpowder, in engineering and mining operations. Two wires of a battery placed at a safe distance are insulated from each other, and their ends, which are connected by a fine iron wire, are sealed up in a tin cartridge filled with gunpowder, and laid in the exploding charge. When all is adjusted, the battery connection is completed, and the current making the iron wire red hot, ignites the gunpowder in the cartridge, and that again the charge. In this way, all danger is avoided. Experiments on the heating effects of the current through wires have proved that *the heat developed is proportional to the resistance of the wires, and to the squares of the strength of the currents; and that the strength of the current being the same, any length of wire may be heated to the same redness.*

Electrolysis is that branch of the science of galvanism which treats of the laws and conditions of electro-chemical decomposition. As this decomposition is generally attended by electro-chemical combination, it is sometimes difficult to distinguish electrolysis from the more general subject of *electro-chemistry*, which embraces all chemical changes resulting in or from the galvanic current. In one case, however, the application of the term is strictly correct—viz., where decompositions are effected by electrodes (poles, see ANODE), which are not attacked by the elements of the electrolyte (the substance decomposed) discharged at them. Throughout the article, there have been frequent allusions to electro-chemical changes, but here we shall discuss more particularly the laws of electro-chemical decomposition. No substance is decomposed by the current so long as it is in a solid or gaseous state, and it must first be brought to a liquid state, either by solution or fusion, before the current acts on it. The decomposition of water by platinum plates is always taken as the type of electrolytic action. In a very convenient apparatus for the purpose, a glass basin is made so as to admit a cork below, through which two wires pass having slips of platinum plate soldered to them above. Two glass tubes, open below, are hung over the plates, to hooks projecting from an upright support. The bowl is filled with acidulated water; and the tubes, after being filled with the same, are inverted, and hung with their lower ends inclosing the plates. When the wires projecting downwards from the cork are connected with the poles of the battery, hydrogen rises from the negative, and oxygen from the positive electrode, to fill each its separate tube. As the decomposition proceeds, twice as much hydrogen is liberated as oxygen. When the tubes are filled, they may be removed and examined. The oxygen thus obtained smells strongly of ozone. Hydrogen is here the type of the metals or other electro-positive substances (cations), which, during electrolysis, are always disengaged at the negative electrode; and oxygen of the salt radicals, chlorine, iodine, sulphur, etc., which, being electro-negative (anions), always appear at the positive pole. Moreover, the proportions of the volumes of the two gases being that of their chemical combining volumes, reminds us that, when a body is decomposed, its components are always separated in the proportions in which they were united, viz., those of their chemical equivalents. If the tubes of this apparatus were graduated, it would serve for a voltameter. If, instead of one such voltameter included in the circuit, we had several, we should find that, whatever amount of gas was liberated in one of these, the same amount would be liberated in all, and that independent of the size of the plates, and amount of acid in each. We learn, therefore, that the chemical power of the current is the same at every point of the circuit where it is manifested. If, instead of two or three voltameters in the circuit, we had one and two decomposing cells of the following description: a test tube, having a platinum wire, on which the glass has been fused, passing through the bottom, is partially filled with stannous chloride, which is kept fused by the heat of a spirit-lamp. The platinum wire at the bottom of the tube forms one electrode, and one descending from the top forms the other, dipping below the fused chloride. If, then, this cell be included in the circuit along with the voltameter, and a similar cell containing fused plumbic chloride, so that the current enters the tubes by the upper electrodes, and leaves by the lower, the water, stannous chloride of tin, and plumbic chloride, are decomposed simultaneously by the current

passing through each. In the voltameter, hydrogen and oxygen are disengaged; in the tubes, metallic tin is deposited at the lower electrode of the one, and lead at the other; whilst chlorine is liberated at the upper electrodes of both. If, now, the quantity of hydrogen, tin, and lead thus set free be weighed, the weights found correspond with their chemical formulæ: H_2O, $SnCl_2$, $PbCl_2$, $H_2=2$, $Sn=118$, $Pb=207$. From such experiments as these, we conclude that *electrolytes are resolved under the action of the current into anions and cations which appear at their respective electrodes in the proportion of their atomic weight, or multiples of their atomic weights.* It is not only in cells exterior to the battery that this law holds, but in the cells of the battery itself. If the battery which effected the above decomposition consisted of six cells, for the equivalent atoms of hydrogen, tin, and lead separated without the battery, equivalent atoms of zinc in each cell would have been dissolved, and an equivalent disengagement of atoms of hydrogen at each of the copper plates, if the cells were one fluid. The above law holds not only for compounds whose elements enter into combination with their usual atomicity, but for those in which the elements, through the same, change their atomic equivalents. Thus, if the same current pass through two decomposing cells, one containing a solution of the cuprous chloride ($CuCl$), and the other of the cupric chloride ($CuCl_2$), the same quantity of chlorine will be disengaged in both, but twice as much copper is deposited in the first as in the second. Here the copper alone changes its atomicity, hence the change in the amount of it in the consecutive cells. The accuracy of the electrolytic law is somewhat compromised by the fact that liquids possess, to a certain extent, the power of conducting, physically, electricity without electrolytic action, so that all that passes in this way is chemically lost. Fortunately, the error thus introduced is very small, and can be therefore practically disregarded.

ELECTRO-METALLURGY is the art of depositing, electro-chemically, a coating of metal on a surface prepared to receive it. It may be divided into two great divisions—electrotype and electro-plating, gilding, etc., the former including all cases where the coating of metal has to be removed from the surface on which it is deposited, and the latter all cases where the coating remains perfectly fixed. Gold, platinum, silver, copper, zinc, tin, lead, cobalt, nickel, brass, bronze, can be deposited electrolytically.

Electrotype—the art of copying seals, medals, engraved plates, ornaments, etc., by means of the galvanic current in metal, more especially copper. The manner in which this is done will be best understood by taking a particular instance. Suppose we wish to copy a seal in copper: an impression of it is first taken in gutta percha, sealing-wax, fusible metal, or other substance which takes, when heated, a sharp impression. While the impression—say, in gutta percha—is still soft, we insert a wire into the side of it. As gutta percha is not a conductor of electricity, it is necessary to make the side on which the impression is taken conducting; this is done by brushing it over with plumbago by a camel-hair brush. The wire is next attached to the zinc pole of a weakly charged Daniell's cell, and a copper plate is attached by a wire to the copper pole of the cell. When the impression and the copper plate are dipped into a strong solution of the sulphate of copper, they act as the negative and positive electrodes. The copper of the solution begins to deposit itself on the impression, first at the black-leaded surface in the vicinity of the connecting wire, then it gradually creeps over the whole conducting surface. After a day or two, the impression is taken out; and the copper deposited on it, which has now formed a tolerably strong plate, can be easily removed by inserting the point of a knife between the impression and the edge of the plate. On the side of this plate, next the copper, we have a perfect copy of the original seal. If a medal or coin is to be taken, we may proceed in the same way, or we may take the medal itself, and lay the copper on it. In the latter case, the first cast, so to speak, that we take of each face is negative, showing depressions where the medal shows relief; but this is taken as the matrix for a second copy, which exactly resembles the original. The adhesion between the two is slight, and they can be easily separated. The cell of a battery is not needed to excite the current. A galvanic pair can be made out of the object to be coated and a piece of zinc. Fig. 8 shows how this may be done. B is a glass vessel, containing sulphate of copper; A is another, supported on B by a wire-frame, and containing a weak solution of sulphuric acid. The glass vessel, A, is without a bottom, but is closed below by a bladder. A piece of zinc, Z, is put in the sulphuric acid, and a wire, D, coated with insulating varnish, establishes a connection between it and the impression, C, which is laid below the bladder. Electrotype is of the greatest importance in the arts; by means of it, engraved copper plates may be multiplied indefinitely, so that proof-impressions need be no rarity; wood-cuts can be converted into copper; bronzes can be copied; and several like applications are made of it too numerous to mention. By connecting a copper plate ready for corrosion with the positive pole, and making it a positive electrode, it can be etched with more certainty than with the simple acid, and without the acid fumes.

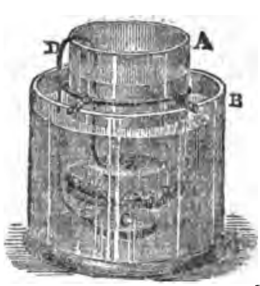


FIG. 8.

Electroplating.—This is the art of coating the baser metals with silver by the gal-

vanic current. It is one theoretically of great simplicity, but requires in the successful application of it very considerable experience and skill. Articles that are electroplated are generally made of brass, bronze, copper, or nickel silver. The best electroplated goods are of nickel silver. When Britannia metal, iron, zinc, or lead are electroplated, they must be first electro-coppered, as silver does not adhere to the bare surface of these metals. Great care is taken in cleaning the articles previous to electroplating, for any surface impurity would spoil the success of the operation. They are first boiled in caustic potash, to remove any adhering grease; they are then immersed in dilute nitric acid, to dissolve any rust or oxide that may be formed on the surface; and they are lastly scoured with fine sand. Before being put into the silvering bath, they are washed with nitrate of mercury, which leaves a thin film of mercury on them, which acts as a cement between the article and the silver. The bath where the electroplating takes place is a large trough of earthenware or other non-conducting substance. It contains a weak solution of cyanide of silver in cyanide of potassium. A plate of silver forms the positive electrode; and the articles to be plated, hung by pieces of wire to a metal rod lying across the trough, constitute the negative electrode. When the plate is connected with the copper or positive pole of a one or more celled galvanic battery, according to the strength required, and the rod is joined with the zinc or negative pole, chemical decomposition immediately ensues in the bath, the silver of the cyanide begins to deposit itself on the suspended objects, and the cyanogen, liberated at the plate, dissolves it, re-forming the cyanide of silver. According, then, as the solution is weakened by the loss of the metal going to form the electro-coating, it is strengthened by the cyanide of silver formed at the plate. The thickness of the plate depends on the time of its immersion. The electric current thus acts as the carrier of the metal of the plate to the objects immersed. In this way, silver becomes perfectly plastic in our hands. We can by this means, without mechanical exertion or the craft of the workman, convert a piece of silver of any shape, however irregular, into a uniform plate, which covers, but in no way defaces, objects of the most complicated and delicate forms. When the plated objects are taken from the bath, they appear dull and white; the dullness is first removed by a small circular brush of brass wire driven by a lathe, and the final polish is given by burnishing. The process of electrogilding is almost identical with that of electroplating. Success in either is attained by proper attention to the strength of the battery, the strength of the solution, the temperature, and the size of the positive electrode.

GALVANIZED IRON. This name is given to iron which has been coated with zinc, to prevent it from rusting. The iron is simply dipped in zinc, and is not coated by any galvanic process, as its name would imply. Zinc, after a short exposure to air, becomes coated with a film of oxide, which does not increase, and this preserves both the zinc itself as well as the iron beneath it from further decay, provided there is no galvanic action going on between the two metals. Probably, however, this action does take place, and the iron is in that case protected by its acting as an electro-negative element to the zinc. But whatever the true explanation of the matter may be, practically it is found that iron so coated resists the oxidizing effects of air and water extremely well.

The process of galvanizing iron is now practiced on a most extensive scale, and like some other so-called inventions of modern times, has been claimed by patentees who were plainly not the original inventors. The French chemist Dumas states that so long ago as 1742, Malouin knew of a plan for coating iron with zinc. There is no doubt of the fact, at all events, for it is stated in bishop Watson's *Chemical Essays*, issued in 1786, that a method (essentially the same as that now in use for zincing iron) was then practiced at Rouen for coating hammered iron saucepans with zinc, and some details of the operation are given. The first English patent for galvanizing iron was granted to Mr. H. W. Craufurd in 1837, and another for the zincing of iron which had been previously tinned was taken out by Mr. E. Morewood in 1821. Like most patents for processes or machines which are commercially successful, these were subjected to much dispute and litigation, and their validity deserved to be attacked. We prefer nowadays to coat our iron cooking-vessels with tin instead of zinc; but in a recently published volume of great interest on the *Industries of Birmingham*, it is stated that "galvanized iron buckets, hardly known 25 years ago, are now sold by tens of thousands weekly."

The process as employed by Mr. Craufurd—and it is still much the same—was first to remove the rust and scale from the iron, by *pickling*—that is, immersing it in dilute sulphuric or hydrochloric acid, either hot or cold; but the former state was preferred; and for this purpose the acid was kept warm in a large leaden bath, sunk in the ground for easier access. After the sheets or other articles of iron have been acted upon by the acid for a few minutes more or less, according to their requirements, they are plunged into cold water, to remove the acid, and afterwards scoured with sand, and again washed clean with water. The iron being now ready to receive its coating of zinc, it is plunged into a bath of that metal, which, previous to its being melted, is coated with a thick layer of dry sal-ammoniac (chloride of ammonium); this melts also, and forms a viscid coating over the metal, which prevents that rapid oxidation to which the molten metal is otherwise liable.

For inferior material the scouring with sand is usually dispensed with. The sheets of iron are then made to pass between two iron rollers in the zinc bath, and are thus more easily drawn through and kept perfectly smooth. Ships' bolts, nails, screws, chains, etc., are dipped in, in bundles, or in the case of nails, etc., in iron strainers; when removed, the zinc makes them adhere together; and to effect their separation, they have to be placed in a crucible with powdered charcoal, in which they are heated to redness, and repeatedly shaken as they cool; by this means they are easily separated.

The important article of telegraph wire, of which the single firm of Messrs. Johnston & Co., Manchester, annually turns out some thousands of miles, is managed entirely by machinery. The iron wire is brought from the drawing-mill, and passed through a pipe kept at white heat by passing through a furnace; this furnace having a row of such pipes set like the tubes of a boiler, but all at the same level, and open at each end, so that the wire has a clear passage through. Next the wire passes at a dull red heat through dilute hydrochloric acid, and immediately after that through a bath of zinc, the process being performed by a self-acting apparatus, having a series of drums. The use of galvanized iron is daily increasing. It is largely consumed in the form of sheets, both plain and corrugated, for roofs, sheds, cisterns, and arches of fire-proof floors; in the state of wire, besides that used in telegraphs, a large quantity is employed for wire-ropes, netting, and the like; and it has innumerable minor applications such as for water-vessels, ship-fittings, and many other articles formerly made of wood, copper, brass, slate, etc. For most of these purposes the zinc coating is much more lasting and less troublesome than paint would be; but still in certain situations, as where it is exposed to the action of sulphurous compounds in smoke, and where its surface is brought directly into contact with other deleterious chemical substances, its use cannot be recommended; and in these circumstances other plans should be resorted to for the protection of the iron.

The plan adopted by Morewood and Rogers for making the variety of galvanized iron called *galvanized tinned iron*, referred to above, is as follows: The sheets or other articles, after being pickled, and scoured, and washed, as in the usual process, are transferred to a large wooden bath. On the bottom of the bath is first placed a layer of finely granulated zinc, then a sheet of the iron, then another layer of granulated zinc, and so on as far as convenient; and the bath is filled up with a diluted solution of chloride of tin, so that by means of the galvanic action produced, the tin becomes deposited thinly over the sheets of iron. The plates are then taken to the zinc bath, prepared exactly as in the ordinary process, where they are dipped or passed through the rollers. By this process, a very even deposit of zinc is produced, and the material so made is preferred for some purposes to ordinary galvanized iron, although its properties are much the same.

GALVESTON, a co. in s.e. Texas, on Galveston bay and the gulf of Mexico, intersected by the Galveston, Houston and Henderson railroad; 680 sq.m.; pop. '70, 15,290—3,236 colored. The surface is level and the soil sandy. Included in the territory is the long low Galveston island. Co. seat, Galveston.

GALVESTON, a city and seaport of the state of Texas, North America, is situated on the n.e. extremity of Galveston island, at the opening of the bay of the same name into the gulf of Mexico; lat. 29° 19′ n., long. 94° 46′ west. It is the largest and most commercial city of Texas. Its harbor, the best in the state, has 12 ft. of water over the bar at low tide. Its streets are straight, spacious, and elegant; and its principal buildings—the Roman Catholic university of St. Mary's, the Roman Catholic cathedral, and the Episcopal church—are large, imposing edifices of brick in the Gothic style. G. has also numerous churches, a convent of Ursuline nuns, and a number of schools of various kinds. In the year ending June 30, 1873, 321 vessels of 163,773 tons entered and cleared the port in the foreign trade; but the greater portion of the trade is along the coast. In the same year, the number of entrances of coasting-vessels was 633 vessels of 566,942 tons, 446 being steamers, regular lines of which ply from this town to New York and New Orleans, as well as to the s.w. towns of Texas. The principal trade, which has increased greatly within the last few years, is the shipping of cotton. The foreign exports in 1873, amounted to nearly $18,000,000, and the imports to about $2,500,000. The town has good wharfs, several ship-building yards, foundries, machine-shops, cotton-presses, etc. Pop. estimated in 1850 at 4,177; and in 1870 it was 13,818. The bay of Galveston extends n. from the city to the mouth of Trinity river, a distance of about 35 m., and is from 12 to 18 m. broad. The island of Galveston is a long strip of low-lying ground with a mean elevation of from 3 to 4 ft. above sea-level, and is about 28 m. long, and from 1½ to 3½ m. broad. It was, from 1817 to 1821, the haunt of the pirate Lafitte, who was dislodged in the latter year.

GALVESTON (*ante*), a city in the co. of the same name in Texas, the chief seaport of the state, on an island between Galveston bay and the Mexican gulf; pop. '70, 13,818. It has railway communication with all parts of the country, and by lines of steamships with Liverpool, New York, New Orleans, and the ports of Texas as far as the Mexican boundary; and sail-vessels engage largely in direct trade with Great Britain and the continent of Europe, in the coffee trade with Rio Janeiro, and in the West India and Mexican trade. There are cotton-presses, with warehouses and yards,

occupying upwards of 40 acres of ground, and storing more than 100,000 bales of cotton. There are 10 m. of street-railway, 2 libraries, 15 churches, schools, a Roman Catholic university, a medical school, an orphanage, savings and national banks, iron-foundries, railroad shops, machine-shops, gas-works, hospitals, daily and weekly newspapers. Oranges and other tropical fruits grow in the open air, and vegetable gardens flourish all the year.

GALVEZ, BERNARDO, Count de, 1756–86; b. Spain; a son of the viceroy of Mexico. He was governor of Louisiana, 1776–83. He took Baton Rouge, Natchez, Mobile, and Pensacola from the English, and rose to be captain-general of Florida and Louisiana. In 1784, he was appointed captain-general of Cuba, and immediately afterwards took his father's place as viceroy of Mexico. He was the builder of the castle of Chepultepec.

GALWAY, a maritime co. of Ireland, province of Connaught, and, after Cork, the largest of all the Irish counties. It is bounded on the E. by two navigable rivers, the Shannon, and its affluent the Suck; and on the w. by the Atlantic ocean. Area, 1,566,-354 acres, of which one half is arable, and most of the rest uncultivated. Pop. '51, 297,897; '61, 254,256; '71, 248,458, of whom 239,902 were Roman Catholics, 7,464 Episcopalians, 615 Presbyterians, and the rest of other denominations. It is watered in the e. by the Shannon, the Suck, and their feeders; and in the w. by loughs Mask and Corrib, and by the streams which fall into these loughs and into Galway bay. In the s. are the Slieve-Baughta mountains; and in the w. are the well-known Twelve Pins, a striking mountain group, with a general elevation of about 2,000 ft. high; and the Maam-Turk mountains, of about an equal height. This western portion of the county is exceedingly wild and romantic; the hills are separated by picturesque glens, and by secluded and beautiful loughs. South-west from Lough Corrib to the sea is the district called Connemara, which contains vast bogs, moors, lakes, and morasses, and presents a peculiarly bleak and dreary aspect. North-east of Connemara is Joyce's country, and s.e. of it is Iar-Connaught, or western Connaught. The coast-line is stated to be about 400 m. in length, and the shore is much broken, and is fringed with numerous islands. On the coasts of Connemara (*Cun-na-mar*, "bays of the sea") and Iar-Connaught, there are more harbors for vessels of large size than on any equal extent of coast perhaps in Europe. The climate is mild and humid, but in low-lying localities is sometimes unhealthy. The richest soil occurs in the district between the head of Galway bay and the Shannon. Agriculture and fishing are the most general pursuits; kelp is largely manufactured; also woolens, linens, friezes, felt hats, are manufactured. The lakes and loughs, as well as the coasts of G., are well stocked with fish. The county of G. abounds in ancient remains of the Celtic as well as of the English period. *Raths* and *cromlechs* are numerous; monastic ruins are found in all parts of the county; a very fine specimen of this class is that of Knockmoy, near Tuam; and there are no fewer than seven round towers in the county. G. county sends two members to parliament.

GALWAY, a municipal and parliamentary borough of Ireland, a seaport, and county of itself, stands at the mouth of the river Corrib on the n. shore of Galway bay, 50 m. n.n.w. from Limerick, and 130 m. w.s.w. from Dublin. It is built on both sides of the river, and on two islands in its channel, its parts being united by two bridges. It is connected with lough Corrib by a canal, and forms the terminus of the Midland Great Western railway. A line of steamers for a time plied between G. and North America, seven days being considered the usual time for a fair passage. The old town of G. is poorly built and irregular, and some of its older houses have a somewhat Spanish appearance, which is accounted for by the commercial intercourse which at one time subsisted between G. and Spain. To one of these houses, which is marked with a skull and cross-bones, a very remarkable story is attached, of a mayor of G., James Lynch Fitzstephen, who, in 1493, like Brutus of old, condemned his own son to death for murder, and in order to prevent his being rescued, actually caused him to be hanged from his own window. The new town consists of well-planned and spacious streets, and is built on a rising-ground, which slopes gradually toward the sea and the river. The suburbs are mainly collections of wretched cabins, inhabited by a miserably poor class of people. One of these suburbs, called Claddagh, is inhabited by fishermen, who exclude all strangers from their society, and marry within their own circle. These fishermen still speak the Irish language, and the Irish costume is still worn by the women. They annually elect a "mayor," whose function it is to administer the laws of their fishery, and to superintend all internal regulations. One of the principal buildings of G. is the parish church of St. Nicholas, founded in 1320, in connection with which is an ecclesiastical body called the royal college of Galway, consisting of a warden and eight vicars choral, who are elected by the Protestant members of the corporation. In the Roman Catholic church a similar ecclesiastical arrangement formerly existed. The see of Enachdune, of which G. formed a part, was united to that of Tuam in 1324; but in 1484, G. was constituted a wardenship, with a distinct jurisdiction, similar to that of an episcopal see. The wardenship, in later times, was held by one of the bishops of the neighboring sees. The right of electing the warden, however, was vested in certain Catholic clans or families of the town—Blakes, Bodkins, Lynches,

Frenches, etc.—who, by a curious local custom, were distributed into 13 tribes. This singular system continued in use until about 50 years ago; when, in 1831, the wardenship of G. was erected into an episcopal see, the bishop of which is appointed as other bishops in Ireland. Among the other edifices are three monasteries and five nunneries; the queen's college, opened in 1849; Erasmus Smith's college, with an endowed income of £126 a year; the county court-house; barracks, etc. G. has numerous flour and other mills, also breweries, distilleries foundries, etc., extensive salmon and sea fishing, a good harbor, with docks that admit vessels of 500 tons, and a light-house The exports consist mainly of corn, flour, bacon, fish, kelp, and marble. In 1876, 363 vessels of 81,590 tons, entered and cleared the port. G. returns two members to parliament. Pop. (1861) of town, 16,786; of parl. b., 24,990; which showed a decrease, since 1851, of 7,001 in the former, and of 9,156 in the latter. The population of town (1871) was 15,597, of whom 14,424 were Roman Catholics, 846 Episcopalians, 171 Presbyterians, and the rest of other denominations.

G. was taken by Richard de Burgo in 1232, and the ancestors of many of the leading families now resident in this quarter settled here about that time. From the 13th till the middle of the 17th c., G. continued to rise in commercial importance. During the latter part of the 17th c., it suffered considerably for its adherence to the royalist cause. In 1652, it was taken by sir Charles Coote after a blockade of several months; and in July, 1691, it was compelled to surrender to gen. Ginkell.

GALWAY BAY, an inlet of the Atlantic ocean, on the w. coast of Ireland, between the counties of Galway and Clare. It is a noble sheet of water, and offers great facilities for an extended commerce. Great efforts were made to obtain a public grant for the construction of a harbor of refuge; and a company was formed in 1858 for the establishment of the transatlantic packet-service alluded to in the article GALWAY. A series of misadventures, however, attended its efforts; and though something was accomplished, the effect was transient, and G. B. relapsed into its former quiet. G. B. is 30 m. in length from w. to e., and has an average breadth of about 10 miles. At its entrance, and between the north and south sounds, are the islands of Arran.

GALYZIN, or GOLYZIN, also frequently GALIZIN, GALITZIN, or GALLITZIN, one of the most numerous, powerful, and distinguished Russian families. It derives its origin from the Lithuanian prince Gedimin, the founder of the Jagellonian dynasty of rulers in Poland, Hungary, and Bohemia. Among the leading members of the family may be mentioned—1. The princes MICHAIL and DIMITRI G., Russian commanders under Wassili IV., grand duke of Warsaw, who were taken prisoners by the Poles at the battle of Orscha in 1514. Dimitri died in captivity, and Michail was only released after a confinement of 38 years.—2. WASSILI G., surnamed the great, b. in 1633, was the councilor and favorite of Sophia, the sister of Peter the great, and regent during his minority. Wassili was a man of liberal culture and civilized tastes. His great aim was to bring Russia into contact with the w. of Europe, and to encourage the arts and sciences in the native gymnasia, and at the court itself. His design to marry Sophia, and plant himself on the Russian throne, however, miscarried. Sophia was placed by her brother in a convent, and Wassili was banished to a spot on the Frozen ocean, where he died of poison.—3. BORIS G., cousin of the previous, was Peter the great's tutor, and one of the administrators of the kingdom during the czar's first journey abroad.—4. DIMITRI G., also a cousin of Wassili's, was a distinguished Russian statesman; ambassador at the Turkish court; afterwards director of the imperial finances; and finally head of the reform party of Galyzin and Dolgoruki, which wished to limit the absolute authority of the czar. Dimitri's plan failed; the two families were banished, and Dimitri himself ended his days in the dungeons of Schlüsselburg.—5. MICHAEL G., b. about 1675, was brother of Dimitri, and one of the most distinguished Russian generals. He was the inseparable companion of Peter the great in all his campaigns. His most famous achievement was the conquest of Finland. He died at Moscow, 1730.—6. DIMITRI G., b. 1738, went as Russian ambassador to France in 1763, and to Holland in 1773. He died in 1803. He wrote one or two books, but he owes the preservation of his name mainly to his wife, the celebrated AMALIE, PRINCESS G., daughter of the Prussian gen., count Von Schmettau. This lady (b. at Berlin, Aug. 28, 1748) was remarkable for her literary culture, her grace and amiability of disposition, her sympathetic relations with scholars and poets, but, above all, by her ardent pietism, which found its most congenial sphere in the mystic and venerable sanctities of Roman Catholicism. Having separated from her husband, she took up her residence in Münster, where she gathered round her a circle of learned companions. Here resided for a longer or shorter time Von Fürstenberg, Goethe, Jacobi, and others, but her most attached friends were Hemsterhuis and Hamann. She is the *Diotima* to whom the former of these, under the name of Dioklas, addressed his *Lettre sur l'Athéisme* (1785). She largely contributed to the conversion of count Stolberg and his family to Roman Catholicism, and called forth that excess of religious feeling which for a considerable period characterized many circles of German society, and which Voss so sharply reproved in his *Wie ward Fritz Stolberg ein Unfreier* (How Fritz Stolberg became a Slave). The princess Amalie died Aug. 24, 1806.—Compare *Denkwürdigkeiten aus dem Leben der Fürstin Amalie von G.* (Münster. 1828).—7. DIMITRI AUGUSTINE G., son of the foregoing, was b. at the Hague,

Dec. 22, 1770. He became a Roman Catholic in his 17th year, shortly after his mother; and through the influence exercised over him by a clerical tutor during a voyage to America, he resolved to devote himself to the priesthood. In 1795, Dimitri Augustine was ordained a priest in the United States by bishop Carroll of Baltimore, and betook himself to a bleak region among the Alleghany mountains, in Pennsylvania, where he was known as "Father Smith." Here he laid the foundation of a town, called Loretto, where he died in May, 1840. A monument was erected to his memory in a neighboring village in 1848. He was austere in his mode of life, but liberal in the highest degree to others, and an affectionate and indefatigable pastor. He wrote various controversial works, some of which are still largely read in the United States. We may mention his *Defense of Catholic Principles; Letter to a Protestant Friend;* and *Appeal to the Protestant Public.*—8. PRINCE EMANUEL G., b. in Paris, 1804, studied in that city, and afterwards entered the Russian army. He translated into French Wrangel's book on northern Siberia, and wrote an interesting work, entitled *La Finlande: Notes recueillies en* 1848 (2 vols., Paris, 1852). He died at Paris, Feb., 1853.

GAMA, Dom VASCO DA, the discoverer of the maritime route to India, was born, it is not precisely known when, at Sines, a small seaport of Portugal. He was descended of an ancient family, which was even supposed to have royal blood in its veins, though not legitimately. At an early period, he distinguished himself as an intrepid mariner; and after the return of Bartolommeo Diaz, in 1487, from doubling the cape of Good Hope, King João, in casting about for a proper man to undertake the discovery of a southern passage to India, fixed on G., so great was the confidence which his abilities inspired. The intentions of João were frustrated by death; but his successor, Manoel the fortunate, fitted out four vessels, manned altogether with 160 men, and intrusted them to the command of G., presenting him at the same time with letters to all the potentates whom it was thought likely he might require to visit; among others, one to the mythical "Prestor John," then supposed to be reigning in splendor somewhere in the e. of Africa. The little fleet left Lisbon July 8, 1497, but having been tormented by tempestuous winds almost the whole way, only arrived at the haven now known as Table bay on Nov. 16, where they cast anchor for a few days. On Nov. 19, G., after encountering a series of frightful storms, and being obliged to sternly suppress a mutiny among his terrified crew, who wanted him to return to Portugal, sailed round the southern extremity of Africa, and touched at various places on the hitherto unknown eastern coast of Africa. At Melinda, where he found the people far more civilized than he expected, he obtained the services of a well-educated pilot, a native of Guzerat, in India, who seemed familiar with the astrolabe, the compass, and quadrant. Under his guidance, G. struck out to sea, crossed the Indian ocean, and arrived at Calicut, in India, on May 20, 1498. His reception by the ruler of Calicut (the "samudri-rajah," or prince of the coast, shortened into zamorin) was not very favorable, nor did G.'s intercourse with him subsequently improve. The Arab merchants residing there were jealous of the new-comers, who might interfere with their monopoly of traffic, and incited the Hindus against them. Other complications also arose, and the result was that, on his departure, G. had to fight his way out of the harbor. Satisfied with the discoveries he had made, the Portuguese commander now turned his course homeward, touched at several of the places he had previously visited, and in Sept., 1499, cast anchor at Lisbon, where he was received with great distinction. High-sounding titles were conferred on him. He was allowed the rare privilege of prefixing *dom* to his name, and obtained a large indemnity for his trouble, besides certain monopolies in the commerce about to be opened with India. King Manoel immediately dispatched a squadron of 13 ships, under Pedro Alvarez Cabral, to India, for the purpose of establishing Portuguese settlements in that country. In this they were successful only in a few places. At Calicut, 40 Portuguese, who had been left behind, were murdered by the natives. To avenge this injury, and, more particularly, to secure the Indian ocean commerce, the king fitted out a new squadron of 20 ships, which set sail under G.'s command in 1502. This fleet reached in safety the e. coast of Africa, founded the Portuguese colonies of Mozambique and Sofala, which still exist, and sailed to Travancore. On his way, G. captured a richly laden vessel filled with Mussulmans from all parts of Asia, on their way to Mecca. He barbarously set it on fire; and the whole crew, amounting to about 300, were burned or slain, with the exception of some 20 women and children. What adds to the tragic character of this fearful incident is, that it occurred through a mistake. G. confounded these Asiatic followers of the prophet with the Moors of Africa, the hereditary enemies of his nation, and proceeded to extremities on that assumption. On reaching Calicut, G., after a delay of a few days, bombarded the place, destroyed a fleet of 29 ships, and compelled the rajah to conclude a peace with suitable indemnification. If this act of vengeance or of punishment, executed as it was with prudence and determination, inspired the natives with fear of the power of the Portuguese, it contributed to confirm the alliances made with several of the native princes. So rapid had been G.'s proceedings, that before the close of Dec., 1503, he was back in Portugal with 13 richly laden vessels. He was not, however, again employed for a period of 20 years; and it would appear that Manoel, for some reason or other, failed properly to appre-

ciate his great services. Meanwhile, the Portuguese conquests in India increased, and were presided over by five successive viceroys, while G. was lying inactive at home. The fifth of these viceroys, however, was so unfortunate, that king João III., the successor of Manoel, was compelled to have recourse to the old hero; and in 1524, bearing the title of viceroy, G. set sail once more for the scene of his former triumphs with a fleet of 13 or 14 vessels. As he approached the coast of India, an unaccountable agitation of the water was observed by all. There was no wind to cause it, and the superstitious sailors were greatly alarmed. "Why fear?" said G., "the sea trembles before its conquerors." His firmness and courage succeeded in making Portugal once more respected in India; but while engaged in his successful schemes, he was surprised by death at Cochin, Dec., 1525. His body was conveyed to Portugal, and buried with great pomp. In the character of G., resolution was found combined with prudence and great presence of mind. His justice, loyalty, honor, and religious fervor distinguished him above most of the great navigators and conquerors of his time. His discovery of a passage to India almost vies in importance with the discovery of America by Columbus, which took place only a few years before. Consult Barros, *Decades;* Castanpeda and Lafitau, *Hist. Conqu. Portug.;* and Cooley, *Hist. Mar. Discov.* His achievements are also celebrated by Camoens in the *Lusiad.*

GAMA GRASS, *Tripsacum*, a genus of grasses, distinguished by unisexual flowers placed in spikes, which are fertile at the base, and barren towards the extremity, the spikelets having two glumes and about two florets, the female florets immersed in the thick and sinuous joints of the rachis, so that the spike, when the seed is ripened, presents the appearance of a cylindrical bone. Only two species are known, of which *T. dactyloides*, the Gama grass of Mexico, distinguished by having spikes usually three together, has a high reputation as a fodder-grass, and is cultivated not only in Mexico, but in the United States of America, and now also to some extent in Europe. In favorable circumstances, it yields a very abundant crop, and attains a height of 9 or 10 ft., its root-leaves measuring 6 ft. in length. It possesses what for some climates is an almost invaluable property of bearing excessive drought without injury. It suffers, however, from frost. It seems eminently adapted to the climate of the Australian colonies.—The other species, the gama grass of Carolina (*T. monostachyon*) distinguished by solitary spikes, is not so much esteemed.—Gama grass is said to derive its name from a Spanish gentleman who first attempted its cultivation in Mexico.

GAM'ALA, an ancient fortress of Palestine, besieged by Agrippa, and captured by Vespasian, when, it is said, 9,000 of the defenders perished. It is supposed to have been on the e. side of the sea of Galilee.

GAMA'LIEL, the Greek form of the Hebrew name *Gamli'el* (*My rewarder is God;* or, *Mine also is God*), the most celebrated bearer of which is Gamaliel I., or the elder (*hasaken*), probably the one mentioned in the New Testament (Acts v. 34, and xxii, 3). Both here and in the Talmudical writings, he appears only in his capacity of a teacher of the law, and a prominent Pharisaic member of the Sanhedrim (q.v.); but of the circumstances of his life, or the date of his birth and death, we learn nothing from these, the only sources. He was the son of Simeon, the same, it may be assumed, who was first honored by the title of raban (our master)—a mark of distinction afterwards bestowed on Gamaliel himself—and thus the grandson of the celebrated Hillel. Whether (as would follow from Pesachim, 88 b.) he actually presided over the Sanhedrim (in the reigns of Tiberius, Caligula, and Claudius) or not, certain it is that the laws and ordinances which were issued by that body during his life bore the stamp of the all-embracing humanity and enlightened liberality which from the "regal" house of Hillel was transferred to the school of Hillel—principally as opposed to the particularizing and austere school of Shamai. To the refinement and erudition hereditary in his family—to which, alone, on account of its exalted position, even the otherwise strictly forbidden study of Greek science and philosophy had been allowed (cf. Derech Eretz, iv.)—G. appears to have added a rare degree of discretion, and of that practical wisdom which betimes revokes or adapts social laws, according to the wants of the commonwealth. For the benefit of sufferers of all kinds, that most stringent law of the limited Sabbath-day's journey was relaxed; the license hitherto allowed to the absent husband, of annulling his letter of divorce (if he regretted his rashness), even after its delivery, before any court of two or three men, was abolished (Gittin, 32); while, on the other hand, to prevent confusion, prepense or involuntary, the strictest accuracy with respect to the names of the husband, wife, and witnesses contained in these documents was most rigorously enforced. Again, the widow was to receive the marriage-portion (Kethuba) from the recalcitrant heirs, simply on her asseveration that she had not received it during her husband's lifetime; while formerly she had not been permitted to make an oath even in the matter (Gittin, 34). But no less important, and testifying, at the same time, to a spirit free from prejudice, are the other laws, respecting the treatment of the Gentiles, which may properly be ascribed to G.'s influence, if indeed they were not inaugurated by himself. Gentile and Jew, it was enacted, should henceforth, without distinction, be allowed the gleanings of the harvest-field; even on the day specially set aside to his idol-worship, the former should be greeted with the salutation of peace. Of his poor, the same care was to be taken; his sick

were to be tended, his dead to be buried, his mourners to be comforted, exactly as if they belonged to the Jewish community (Gittin, 59 b., 61 ff.; Jer. Gitt. c. 5)—certainly no mean tribute to the principle of the equality of the human race, and a practical carrying out of Hillel's motto, the words of the Scripture (Lev. xix. 18), "And thou shalt love thy neighbor as thyself" (cf. Sabbath, 30 b. ff.). The consideration of these and other legislative acts, all tending towards that social improvement and consolidation (*Tikkun Haolam*) which was G.'s avowed and acknowledged aim, seems also to set at rest that old and barren dispute, whether G., when he interposed on behalf of the apostles, and referred their matter to God himself, was secretly a Christian, or whether he was "a cowardly tyrant, who even sought to withhold from them the privilege of martyrdom." Tolerant, peaceful, as free from fanaticism on the one hand, as on the other from partiality for the new sect, which he seems to have placed simply on a par with the many other sects that sprang up in those days, and disappeared as quickly; he exhorts to long-suffering and good-will on all sides. Of his relation to St. Paul, of the "law" he taught him (Acts, xxii. 3), as well as of the influence which his mind might have exercised over that of the "apostle of the Gentiles," we shall treat under the name of this latter.

When G. died (about 17 years before the destruction of the temple), "the glory of the law" was said to have departed, and with him "died the reverence before the law and the purity of *the abstinence*" (Pharisaism), (Sota, 49). His memory has always been held in the highest honor. The story of his conversion to Christianity, we need scarcely add, is as devoid of any historical foundation as that of the transmission of his bones to Pisa. In conclusion, it may be mentioned, that G. has been placed on the list of Christian saints, and that his day is celebrated on Aug. 3.

GAMB, an heraldic corruption of the French word jambe, the leg. See JAMBE.

GAMBA. See VIOL DI GAMBA.

GAMBESON, or WAMBEYS, a word of doubtful origin, implying a covering for the body, was the name of a thickly quilted tunic stuffed with wool, and worn by knights under the hauberk, as a padding for the armor. As it was sufficiently strong to resist ordinary cuts, it was sometimes worn without other armor. The surcoat was also quilted or *gamboised* with cotton wool, as in that of the Black Prince, still hanging above his tomb in Canterbury cathedral.

GAMBETTA, LÉON, a French lawyer and statesman, was b. on Oct 30, 1838, at Cahors. His family was of Genoese descent. He studied law; and in 1859 joined the Paris bar. It was not till 1868 that his name came prominently before the public. He then acquired fame as counsel for defendants in political prosecutions. He showed himself an able and determined enemy of the second empire. He was in consequence returned to the chamber, both at Paris and Marseilles, at the elections of 1869. On May 5, 1870, he delivered a speech containing a panegyric of the republican form of government, which attracted great attention. After Sedan, he became minister of the interior, and he remained for some time in Paris after it was invested by the Germans: as he was anxious, however, to stir up the provinces, he contrived to escape from the city by a balloon. He came down at Amiens, and thence proceeded to Tours, where he was intrusted with the control of the war department. He assumed unlimited power, and made every effort to stir up the provinces in defense of Paris. He preached *guerre à outrance* against the Germans, and denounced the capitulation of Metz as an act of treason on the part of Marshal Bazaine. When a national assembly was resolved upon in 1871, G. sought by a decree to give it an exclusively republican character by directing that no official of the second empire should take part in the election. The decree was canceled at the instigation of prince Bismarck, and G. resigned office as minister. He subsequently entered the assembly as a member for Paris, became the leader of the extreme left, and to the violence of a speech which he delivered at Grenoble, was largely attributed the reaction which set in against republican government, and the retirement of M. Thiers. After this his political action became more skillful and moderate, and to his leadership the republicans greatly owed their success in the elections of 1877, and their defeat of the attempts of the conservatives to deprive them of its results. Yet in the same year he was twice prosecuted for undue outspokenness, and once condemned to imprisonment. On the elevation of M. Grévy to the presidency of the republic in 1879, G. became president of the chamber of deputies.

GAMBIA, a river of western Africa, whose basin, and that of the Senegal, constitute the region known as Senegambia, enters the Atlantic in lat. 13° 30′ n., and long. 16° 34′ w., after an estimated course of fully 1000 miles. It is 4 m. broad at its mouth, having a reach of double the width immediately inside. It is navigable for vessels of 150 tons up to Barraconda, a town on its right bank, about 200 m. from the sea.

GAMBIA, a British settlement occupying the banks of the river of the same name, as far up as Barraconda, though not continuously. The principal station, Bathurst, is situated on the island of St. Mary, at the mouth of the Gambia. Other posts are Fort James and Fort George, the former also situated on St. Mary's, and the latter on Macarthy's island, 180 m. from the sea. Pop. of settlement in '71, 14,190, of whom 56 were whites. The climate is comparatively healthy, indeed the most healthy European set-

tlement in western Africa. The export trade, already considerable, is steadily increasing, comprising chiefly wax, hides, ivory gold-dust, rice, palm-oil, horns, timber, and ground-nuts. The total public revenue in 1874 was £20,200, and the expenditure £23,-400. In the same year the trade with Britain amounted to £310,000. G. is a dependency of Sierra Leone; and its natives are reported to be superior to the other intertropical tribes of Africa in intelligence and civilization. Education is well attended to.

GAMBIER, a village in Knox co., Ohio, on the Vernon river and the Cleveland, Mount Vernon and Columbus railroad; 51 m. n.e. of Columbus; pop. '70, 581. It is the seat of Kenyon college, an institution of the Prot. Epis. diocese of Ohio, comprising, besides the academical department, a theological seminary and a grammar-school. See KENYON COLLEGE.

GAMBIER, JAMES, Baron, 1756–1833: an English admiral, b. Bahamas, where his father was lieut. governor. He entered the navy as a midshipman in 1767, was post captain in 1778, and after the peace with America was placed on half pay. On the commencement of the French revolution, he was appointed to the command of the 74-gun ship *Defense* under lord Howe; and had an honorable share in the action off Ushant, June, 1794. In recognition of his services on this occasion, G. received the gold medal, and was made a colonel of marines; the following year he was advanced to the rank of rear-admiral, and appointed one of the lords of the admiralty. In 1799, he was made vice-admiral. In 1802, he was appointed governor of Newfoundland and commander-in-chief of the ships on that station. In 1804, he returned to the admiralty, and in 1805 was raised to the rank of admiral; and in the summer of 1807, whilst still a lord of the admiralty, he was appointed to the command of the fleet ordered to the Baltic, which, in concert with the army under Lord Cathcart, reduced Copenhagen and enforced the surrender of the Danish navy, consisting of 19 ships of the line, besides frigates, sloops, gun-boats, and naval stores. For this service admiral G. was rewarded with a peerage. In the spring of the following year he gave up his seat at the admiralty on being appointed to the command of the channel fleet; and in that capacity he witnessed the partial, and prevented the total, destruction of the French fleet in Basque roads, April 12, 1809. It is in connection with this event that lord Gambier's name is now best known. A court-martial, assembled by order of a friendly admiralty, and presided over by a warm partisan, "most honorably acquitted" him on the charge "that, on April 12, the enemy's ships being then on fire, and the signal having been made that they could be destroyed, he did, for a considerable time, neglect or delay taking effectual measures for destroying them." In 1814, he acted as chief commissioner for negotiating a treaty of peace with the United States; for his exertions in which business, he was honored with the grand cross of the bath. In 1830, he was raised to the high rank of admiral of the fleet.

GAMBIER ISLANDS, a Polynesian group, under a French protectorate, in lat. 23° 8' s., and long. 134° 55' west. They number five larger and several smaller islands, all of coral formation. With the exception of Pitcairn's island, they alone, on the route between Chili and Tahiti, yield good water sufficient for the supply of shipping.

GAMBIR, or GAMBEER, an astringent substance resembling catechu (q.v.), and used for the same purposes. It is one of the most powerful of pure astringents. It is prepared from the leaves of the *uncaria gambir*, a native of the East Indies and Malay Archipelago. The genus *uncaria* belongs to the natural order *cinchonaceæ*. The G. shrub is very extensively cultivated in the Eastern Archipelago, great quantities of the light and brown yellow G. being used in preparing betel for chewing. G. is obtained by boiling the leaves for a long time in water, and evaporating either by the heat of a fire or of the sun. The finer sorts are used in Europe as a medicine, and the black kind in tanning. It is often called *terra japonica* in commerce. When examined by the microscope, G. is found to consist, in great part, of a multitude of small crystals of *catechine*.

GAMBLING, or GAMING, the art or practice of playing a game of hazard, or one depending partly on skill and partly on hazard, with a view, more or less exclusive, to a pecuniary gain. Games of this nature were forbidden by the Romans both under the republic and the empire (Cic. *Philip.* ii. 23; *Dig.* ix. tit. 5; *Cod.* iii. tit. 43). The ground on which this was done was the tendency of such practices, not to demoralize the populace, but to render them effeminate and unmanly. Horace (*Carm.* iii. 24) complains that youths of condition, instead of riding and hunting, had betaken themselves to illegal games of chance. It belonged to the ædiles to attend to the public interest by punishing violations of the gaming laws. During the saturnalia, which was a period of general license, these games were permitted (Martial, iv. 14), and a like indulgence at other seasons was extended to old men both amongst the Greeks and Romans (Eurip. *Med.* 67; Juv. xiv. 4). Nor has this vice been confined to civilized nations, either in the ancient or the modern world; Tacitus (*De Mor. Ger.* c. 2) mentions its existence amongst our own barbarian forefathers, and it is known to prevail amongst many half-civilized and even savage tribes at the present day. In general, it is resorted to as a refuge against the depressing sensations of languor and vacancy, which the want of active exertion causes in the minds of those who have no inner life; and the classes

most addicted to it in all countries are the idle, and mere men of business in their idle hours.

It is remarkable that in England, as in Rome, the ground on which gambling was first prohibited was, not its demoralizing, but its effeminating influences on the community. The act 33 Henry VIII. c. 9 (1541) had in view the double object of "maintaining artillery and debarring unlawful games." By "artillery" appeared to be meant archery; and the act, reciting two others in the same reign, contained the preamble, that the skill of the people in this martial art "is sore decayed, and daily is like to be more and more minished." The cause of this degeneracy was stated to have been the practice among the people of "many and sundry new and crafty games," which not only diverted popular attention from the more manly and patriotic art of shooting with the bow, but gave rise to murders, robberies, and other felonies. The act then contained anxious provisions for the revival of the art of shooting with yew bows, and other particulars not now requiring notice, as that part of the statute has been repealed. On that act followed 16 Charles II. c. 7, and 9 Anne, c. 14, the latter of which declared that all bonds, or other securities given for money won at play, or money lent at the time to play with, should be utterly void, and all mortgages or incumbrances of lands made on the same consideration, should be made over to the use of the mortgager. This statute applied to Scotland, where the nullity was found to affect any one holding a bond or bill as trustee for the winner, but not onerous or *bona-fide* indorsers, without notice of the objection (Bell's *Com.* i. p. 28, Shaw's edition). Such continued to be the statute law till 1845, when there was passed the act 8 and 9 Vict. c. 109, which, though it repealed the obsolete provisions of 33 Henry VIII. and 16 Charles II. c. 7, and 9 Anne, c. 14, re-enacted the former prohibitions against card-playing and other games, and was followed up (in 1853 and 1854) by the acts for suppressing betting-houses, 16 and 17 Vict. c. 119, and gaming-houses, 17 and 18 Vict. c. 38. By 8 and 9 Vict. c. 109, the common law of England was altered, and wagers, which, with some exceptions, had hitherto been considered legal contracts, were declared to be no longer exigible in a court of law. This prohibition does not affect contributing to prizes for lawful games. In Scotland, an opposite rule had been followed, the judges having held, irrespective of the character of the game, or of any statutory prohibition regarding it, that "their proper functions were to enforce the rights of parties arising out of serious transactions, and not to pay regard to *sponsiones ludicræ.*" The partial assimilation which has now been effected in this respect between the laws of the two countries is one the desirableness of which had been pointed out by many eminent English judges, from the time of lord Mansfield down to the passing of the act, and which was at last adopted in accordance with the report of a select committee of the house of commons in 1844. By this statute, it is also provided that cheating at play shall be punished as obtaining money under false pretenses. It also facilitates proceedings against common gaming-houses, by enacting that where other evidence is awanting, it shall be sufficient to prove that the house or other place is kept or used for playing at any unlawful game, and that a bank is there kept by one or more of the players exclusively of the other; or that the chances of any game played therein are not alike favorable to all the players, including among the players the manager or managers of the bank. The mode of enforcing the act 8 and 9 Vict. c. 109 was defective, and the act 17 and 18 Vict. c. 38 put heavy penalties on those who obstructed the police by putting chains or bolts against the doors of gaming-houses, or otherwise delaying the entry into such houses, and any apparatus or arrangement for giving alarm to the persons inside was declared to be evidence that the house was a gaming-house. The persons found inside, and giving a false name or address, were made liable to a penalty of fifty pounds. The owner or keeper of the house is liable in a penalty of £500. The frequenters of the house are liable also to be examined, and if making true and faithful discovery, are freed from all punishment. The betting-houses' act, 16 and 17 Vict. c. 119, was passed to put down another kind of gaming—namely, in houses where money is received as or for the consideration for any undertaking to pay money in the event of any horse-race or other race, fight, game, sport, or exercise. All such betting-houses are declared to be gaming-houses within the statute 8 and 9 Vict. c. 109, and similar powers of search may be resorted to. But nothing in the act extends to a person holding stakes to be paid to the winner of any race or lawful sport, game, or exercise. Besides these statutes, the intoxicating liquors licensing act of 1872 puts a penalty on the keeper of any house for the sale of liquors allowing any gaming for money or money's worth on the premises. By the vagrant acts, all persons are liable to penalties for playing at games on a public highway or public place, and a similar act, 32 and 33 Vict. c. 87, passed for Scotland. The betting-house act and gaming-houses acts did not at first extend to Scotland, the common law, which prevented gaming debts being recoverable, obviating much of the evil incident to gaming, but since 1874, it has included that country also. These enactments do not interfere with gaming in private houses.

In most of the states of Germany, gaming was allowed, and the extent to which it was practiced at the German watering-places was well known. The princes of the petty states often derived a large portion of their revenue from the tenants of their gaming establishments, whose exclusive privileges they guaranteed. Recently, these German gaming-tables have all been closed. Monaco has now the chief public gaming-

tables of Europe. Abstracts of the laws of different countries relating to gaming were some years ago laid before the house of commons. See vol. 3 of the Political Dictionary of the *Standard Library Cyclopædia.*

GAMBOGE, or CAMBOGE, a gum-resin, used in medicine and the arts, brought from the East Indies, and believed to be the produce chiefly of *Cambogia gutta*, also known as *hebradendron gambogioides*, a tree of the natural order *guttiferæ*, a native of Ceylon, Siam, Cambodia, etc. The gamboge-tree attains a height of 40 ft., has smooth oval leaves, small polygamous flowers, and clustered succulent fruit. The fruit is about 2 in. in diameter, sweet and eatable, and is also much used as an ingredient in sauces. When the bark of the tree is wounded, G. exudes as a thick viscid yellow juice, which hardens by exposure to the air. Another species of the same genus (*C. pictoria*) occurs in the Mysore; and is believed to produce G. of similar quality. The finest G. comes from Siam. *American G.*, which is very similar, and used for the same purposes, is obtained from *vismia Guianensis*, a tree of the natural order *hypericineæ*, a native of Mexico and Surinam.

G. occurs in commerce in three forms: 1. in *rolls* or *solid cylinders;* 2. in *pipes* or *hollow cylinders;* and 3. in *cakes* or *amorphous masses.* The first two kinds are the purest. Good G. contains about 70 per cent of resin and 20 per cent of gum, the remainder being made up of woody fiber, fecula, and moisture. On evaporating to dryness the ethereal texture of the pure gum-resin, we obtain a deep orange-colored or cherry-red substance, to which the terms *gambogic* and *gambodic acid* have been applied. Its composition is represented by the formula $C_{40}H_{23}O_8$, according to Johnston (*Phil. Trans.* 1839).

As the detection of G. in quack medicines, etc., is occasionally of great medico-legal importance (death having often taken place in consequence of the administration of Morison's pills and similar preparations), we may mention the following simple mode of procedure. Digest one portion of the suspected substance in alcohol, and another in ether. In each case, if G. is present, we obtain an orange-colored tincture. The ethereal tincture dropped in water yields, on the evaporation of the ether, a thin, bright-yellow film of gambogic acid, which is soluble in caustic potash. The alcoholic tincture dropped into water yields a bright, opaque, yellow emulsion, which becomes transparent, and of a deep red color on the addition of caustic potash. On the addition of acetate of lead to either of these solutions, we have a yellow precipitate of gambogiate of lead; similarly, sulphate of copper yields a brown, and the salts of iron a dark-brown precipitate of the respective gambogiates of copper and iron.

In doses of a drachm, or even less, G. acts as an acrid poison, causing extreme vomiting and purging, followed by fainting and death. In small doses of from one to three grains, combined with aloes and ginger or aromatic powder, it may be given in case of obstinate constipation, in cerebral affections (as apoplexy, or where there is an apoplectic tendency), in dropsy (especially if connected with hepatic obstruction), and as a remedy for tape-worm. The use of G. is objectionable when there is an irritable or inflammatory condition of the stomach or intestines, or a tendency to abortion; and it is not very often prescribed by orthodox practitioners.

G., is much used by painters to produce a beautiful yellow color. It is also employed for staining wood, and for making a gold-colored lacker for brass. It has a shelly fracture, is destitute of smell, and has an an acrid taste. It burns with a denso smoke and many sparks.

GAME. Certain wild animals are selected by what are called the game-laws from all other animals, and protected, for the exclusive benefit of those on whose lands they are found. Game-laws of one kind or another exist in all modern countries, and controversies are constantly going on as to whether they are not too stringent. In ancient times, our kngs distinguished themselves by the severity of the forest laws, from which the modern game-laws are descended; but the crown has now little to do with G., except where certain ancient forests, parks, and free warrens are to be found, and these continue to this day to be privileged places in many respects. The game-laws of England, Ireland, and Scotland are still quite distinct, and though in the most material parts they agree, yet there are several peculiarities to be attended to. The English statutes on the subject now in force are the game act 1 and 2 Will. IV. c. 32, and its amendments, 5 and 6 Will. IV.; c. 20, and 6 and 7 Will. IV. c. 65; the night poaching act, 9 Geo. IV. c. 69, and its amendment, 7 and 8 Vict. c. 29; the larceny act, 24 and 25 Vict. c. 96; the hares' killing act, 11 and 12 Vict. c. 29, and the game licenses' acts, 23 and 24 Vict. c. 90, and the poaching act, 25 and 26 Vict. c. 114. These form the statute law on the subject, and there is interwoven with them the common law, both of which require to be taken together. Our present space precludes our giving more than the substance of the leading doctrines on the subject.

Blackstone laid down the doctrine, that at common law the sole right of hunting and killing G. belonged to the crown, and that the subject could only claim this right by tracing title to the crown This doctrine has, however, been clearly shown to be erroneous, and prof. Christian was the first to point it out. It is now well settled that at common law the owner of the soil, or, if he has granted a lease without reserving the right, then the lessee or occupier, has the right to kill and catch every wild animal that

comes on his lands. This is still the law, but the game-laws have made it necessary that the owner, or other person having the legal right, shall, before doing so, take out a game-license—in other words, pay a tax to the state. Not only is a game-license necessary in all cases, but there is a certain season, called the close season, during which it is unlawful for every person, whether having the legal right or not, to catch or kill game. G. is defined to include the following animals only—viz., hares, pheasants, partridges, grouse, heath-game, moor-game, black-game, and bustards. The close season applies only to the winged G., so that hares can be lawfully killed all the year round. But no G. must be killed on Sundays or Christmas-day; to do so, subjects the offender to a penalty of £5. Though the above animals alone are G., the G. acts also protect certain other animals—viz., woodcocks, snipes, quails, land-rails, and conies; that is to say, any person illegally trespassing in pursuit of these may be fined £2. The eggs of game are also protected. In general, the game-laws consist merely of a net-work of penalties directed against these illegal trespasses, and these will be more properly stated under the head of poaching (q.v.). Trespasses in the night-time, in pursuit of G., are punished more severely than those in the day-time; and when there are several persons acting together, exceeding five, the penalties are increased, and still more so when the poachers are armed with dangerous weapons, and use violence.

As between landlord and tenant, the general rule is, that, if there is no provision to the contrary in the lease, the tenant has the exclusive right to kill the G., and not the landlord; hence the landlord, in order to preserve the right, must always introduce an express clause in the lease for his protection. When that is done, then the tenant may be punished like other persons for poaching. Formerly, it was attempted to protect lands against poachers by setting spring-guns and man-traps, and the English courts were inclined to hold this to be legal. But to put an end to all doubt, a statute was passed, and is now in force, which expressly prohibits spring-guns except to protect dwelling-houses (24 and 25 Vict. c. 100, s. 31).

In order to discountenance poaching, G. is declared not to be a legal article of sale except by licensed game-dealers; this license costs £2. The game-dealer can only buy his G. from licensed sportsmen, and it is an offense for any of the public to buy G. except from the licensed dealers, or to sell G. without a license; but sportsmen are not prohibited from making presents of G. to any person.

As regards *game-licenses*, these are now of two kinds: one is annual, and costs £3: the other lasts about half the year, and costs £2. A gamekeeper's license costs £2. These licenses are necessary, not merely to kill G., but also to kill deer, woodcocks, snipes, quails, land-rails, and conies or rabbits. An exemption, however, exists, as regards hares and rabbits, when the owner or occupier kills these on his own inclosed ground, or directs another person to do so, in which case no license is necessary; but this exemption only applies when the lands are inclosed or fenced, and the owner or occupier has otherwise the legal right to kill the hares and rabbits. No license is required for merely hunting with staghounds, greyhounds, or beagles, or killing deer in one's own park. Moreover, attendants or friends going out with licensed sportsmen, provided these merely assist, and do not play a principal part, do not require a license. But in all other cases it requires a license, not only for killing, but for pursuing G., and it is thought for taking away dead G. from a highway or field. Assessed taxes must also be paid for dogs—viz., for each dog 5*s*., but no license for the gun. See Paterson's *Game Laws of the United Kingdom*.

The policy of the game-laws has often been questioned. Mr. Bright obtained a committee of the house of commons in 1845, who examined the subject. These laws are represented, on the one hand, to be far too stringent, to be badly administered by interested justices, and, lastly, to be opposed to the moral sentiments of the lower orders, who persist in treating such offenses as venial, if not praiseworthy. On the other hand, owners of land say that they are entitled to protection against trespassers, and this is the only way by which they can be protected.

In Scotland, several of the foregoing statutes, such as the night poaching act and the game licenses act, also apply. There is a similar act as to day-poaching—viz., 2 and 3 Will. IV. c. 68, and as to hares, 11 and 12 Vict. c. 30. The provisions in the English act as to game-dealers and the sale of G. also apply. But in Scotland, not only a game-certificate, but a qualification, is requisite to enable a person to shoot, except he has the permission of a qualified person. In Scotland, the close season differs slightly from that of England, and so does the definition of game. In Scotland, if nothing is said in the lease, the right to the G. belongs to the landlord, and not to the tenant. A tenant has also a right of action against the landlord for excessive preserving, if extraordinary injury is thereby done to his crops—a right which does not exist in England or Ireland. The game-laws amendment (Scotland) act of 1877, by transferring G. cases to the sheriff-courts, saves justices of the peace from trying cases to which they are parties, and provides the sheriff with some means of measuring the damage done by game.

In Ireland, the law is nearly the same in substance with that of England; but there still remain a few minor differences as to the qualification to kill G., as to the definition of G., of close-time, etc.

GAM'ELYN, the hero of an English legend interesting only as furnishing Shakespeare with the plot of *As You Like It*. The story relates that G. was the youngest of three

sons of sir John de Boundyd. The eldest son took charge of him, but treated him shamefully. He sent his servants to chastise the youngest, having already demanded his heritage; but G. beat them off. At a wrestling match he threw the champion, and carried off the prize ram; but on reaching home and finding the door shut against him, he kicked down the door and threw the porter into a well. The elder brother, by a maneuver, contrived to bind the young scapegrace to a tree, and left him two days without food; but Adam, the spencer, unloosed him, and G. fell upon a party of ecclesiastics who had come to dine with his brother, "sprinkling the holy water on the guests with his stout oaken cudgel." The sheriff now sent to take G. and Adam into custody; but they fled into the woods and came upon a party of foresters sitting at meat. The captain gave them welcome, and in time G. rose to be "king of the outlaws." His brother, being now sheriff, would have put him to death, but G. captured him, constituted himself a judge, and hanged his brother. After these strange exploits, the king appointed him chief ranger; he married, and seems to have grown more peaceable.

GAMES, ANCIENT. The public games of Greece and Rome were athletic contests and spectacles of various kinds, generally connected with religious observances. Probably no institution exercised a greater influence than that of the public contests of Greece in molding the national character and producing that unique type of physical and intellectual beauty reflected in Greek art and literature. From the noble spectacle of the Greek Olympia the course of public games can be traced downward to the Roman amphitheater, of whose degradation and horror a faint picture may be formed from its last survival—the Spanish bull-fight. The earliest games of which there is any record are those at the funeral of Patroclus, which form the subject of the 23d Iliad. They are noticeable both as showing that the belief that the dead would be appeased or gratified by the same exhibitions which pleased them in life was a common heritage of Greeks and Romans from their Aryan progenitors; and as already including all the distinctive competitions which we find in historical times—the chariot-race, archery, boxing, wrestling, and putting the weight. Each of the great Grecian games was held near some shrine or consecrated spot, and is connected by myth or legend with some hero, demigod, or local deity. See OLYMPIC GAMES, PYTHIAN GAMES, NEMEA, ISTHMUS, CIRCUS, and AMPHITHEATER, *ante*.

GAMMA, GAMME, or GAMMUT, the name given to the system of musical notation invented by Guido, the first note of which he called by the Greek letter gamma. Later, the whole scale got the name of gamma, but it afterwards fell into disuse with Guido's solmization. In modern music, the term is applied to the scale or compass of wind instruments.

GAM'MARUS, a genus of *crustacea* of the section *edriophthalma* (q.v.), and order *amphipoda*, of which one species, *G. pulex*, is extremely common in springs and rivulets in Britain, particularly where decaying vegetable matter has accumulated. It generally keeps near the bottom; swims on its side, with a kind of jerking motion, and feeds on dead fishes or any other animal matter. It is sometimes called the fresh-water shrimp.

GAMMELL, WILLIAM, LL.D., b. Mass., 1812; a graduate of Brown university, and a tutor there; professor of rhetoric and English literature, and afterwards of history and political economy. Besides many contributions to the periodical press, he has published *Life of Roger Williams; Life of Gov. Samuel Ward;* and *History of American Baptist Missions.*

GAMRUN. See GOMBROON.

GAND. See GHENT.

GANDERSHEIM, a t. in Germany, at the head of a circle in the duchy of Brunswick, situated on the Gande, a sub-tributary of the Weser, about 48 m. s.w. of Brunswick; pop. '75, 2,454. It has manufactures of linen, cigars, beet-root sugar, and beer; and possesses an old palace built by the dukes of Brunswick in the 16th c., and an abbey which is one of the most famous in Germany. The abbey of G. was founded in 856, according to Eberhard's chronicle by the duke Ludolf of Saxony, and his wife Oda, who removed to the new domicile the nuns whom they had shortly before established at Brunshausen. Their own daughter, Hathumoda, was the first abbess. King Louis III. granted a privilege by which the office of abbess was to continue in the ducal family as long as any member was found competent and willing to accept the same. Otto III. gave the abbey a market, a right of toll, and a mint. Pope Innocent III. declared it altogether independent of both bishop and archbishop. The abbey was ultimately recognized as holding directly of the empire, and the abbess had a vote in the diet as a member of the Rhenish bench of bishops. The conventual estates were of great extent, and among the feudatories who could be summoned to the court of the abbess were the elector of Hanover and the king of Prussia. Protestantism was introduced in 1568, and Magdalena, the last Roman Catholic abbess, died in 1589; but Protestant abbesses were appointed to the foundation, and continued to enjoy their imperial privileges till 1802, when G. was incorporated with Brunswick. The last abbess was a princess of the ducal house, and kept her rank till her death. The abbey has also a celebrity through its literary memorials.

GANDIA, a beautiful t. of Spain, in the province of Valencia, and 34 m. s.s.e. of the town of that name, stands on the left bank of the Alcoy, about 2 m. from the sea. It is well built, with streets regular and spacious; is surrounded with walls and towers, has numerous ecclesiastical edifices, and a magnificent ducal palace, adorned with gilding and *azulejos* or colored tiles. Its gardens are fertile and luxuriant beyond description. It has manufactures of linen, woolen, and silken fabrics, and a trade in rice, hemp, silk, and timber. Pop. 7,000.

GANDO. 1st, a kingdom or empire of Súdan, situated on both sides of the Niger. It is bounded on the n.w. by the empire of Songhay, and on the s.e. by the empire of Sókoto. It consists of the provinces of Western Kebbi, Maúri, Zabérma, Déndina, parts of Gurma, Borgu, and Yoruba, Yaúri, and Núpe. The country is fertile, and the vegetation in many places luxuriant. The principal productions are the yam, the date, and the banana. The inhabitants are of the Fulah (q.v.) race, and mostly Mohammedans. When Dr. Barth visited G. in 1853, the monarch or sultan was Khalílu, nephew of the great reformer Imám Othman (see FULAH). He is described by that traveler as a "man without energy, and most inaccessible to a European and a Christian"—living, in fact, in a state of monkish seclusion, and employing a younger brother to "keep up a certain show of imperial dignity." It is not surprising that under such a ruler Dr. Barth should find "most of the provinces plunged into an abyss of monarchy."—2d, GANDO, a city, and capital of the above kingdom, lies in a narrow valley, surrounded and commanded by hilly chains. "It is intersected," says Dr. Barth, "from n. to s. by the broad and shallow bed of a torrent, which exhibited fine pasture-grounds of fresh succulent herbage, while it was skirted on both sides by a dense border of luxuriant vegetation, which altogether is much richer in this place than either in Sókoto, or Wurno, being surpassed only by the fine vegetable ornament of Kano." The interior of the place is very pleasant and animated, and the inhabitants are industrious and successful in the manufacture of cotton cloth.

GANDOLFO. See CASTEL-GANDOLFO.

GANE'LON, Count of Mayence, one of Charlemagne's paladins, called the "Judas" of knights. It is said that his castle was built on the Blocksberg, the loftiest peak of the Harz mountains. Jealousy of Roland made him a traitor; and in order to destroy his rival, he planned with Marsillus, the Moorish king, the attack of Roncesvalles. He was six and a half feet high, with glaring eyes and fiery hair; he loved solitude, was very taciturn, disbelieved in the existence of moral good, and never had a friend. His name is a by-word for a traitor of the basest sort.

GAN'ESA, in Hindu mythology, son of Siva and Parbutta; also called Gunputty, the elephant god. He has been called the Mercury of the Hindus—the god of wisdom, forethought, and prudence.

GANGA, or SAND-GROUSE, *Pterocles*, a genus of gallinaceous birds, of the family *tetraonidæ*, closely allied to grouse and ptarmigan, but distinguished by a pointed tail. The toes are not feathered. The species are natives chiefly of the warm parts of Asia and of Africa, and are most abundant in arid sandy plains. Two species, the banded sand-grouse (*P. arenarius*) and the pin-tailed sand-grouse (*P. setarius*), are found in the s. of Europe. The latter species is very abundant on the arid plains of Persia. In Europe, it is found as far n. as the s. of France, chiefly in the sterile *Landes*. It is always to be seen in the markets of Madrid. The banded sand-grouse is abundant in the s. of Russia. The African species are often to be seen in large flocks near their drinking-places. The sand-grouse sometimes visits the shores of Great Britain.

GANGA SAGOR, a low swampy island at the mouth of the great western or holiest branch of the Ganges, particularly sacred in the estimation of the Hindus. Multitudes of pilgrims annually resort to it, at the time of full moon, in Nov. and in January. Infanticide formerly took place to a vast extent at these festivals, but is now prohibited by the British government.

GANGES, a river prominent alike in the religion and in the geography of the east, divides, at least towards the sea, India in its largest sense into the two grand divisions of *Hither* and *Farther*. Its entire length is more than 1500 miles. Its general direction during the first half of its course is s.e.; it then flows e. through the plain of Bengal, as far as Rajmuhal, a distance of about 400 m., after which it again proceeds in a south-eastern direction, and enters the sea through a multitudinous delta. For the purposes of detailed description, the stream, which exhibits such a great variety of phases in the different parts of its course may be conveniently broken down into five sections: (1) from its springs to Gangotri; (2) from Gangotri to Hurdwar; (3) from Hurdwar to Allahabad; (4) from Allahabad to Seebgunge, or the head of the Delta; (5) from Seebgunge, or the head of the Delta, to the bay of Bengal.

From its Springs to Gangotri.—The Bhageerettee, Bhagirathi, or Bhaghireti, generally regarded as the true G., rises in Gurhwal, near lat. 30° 54′ n., and long. 79° 7′ e., from a snow-field imbedded between three mountains of about 22,000 ft. in height. The actual spot from which it is seen to issue is itself 13,800 ft. above the sea. After a course of 10 m., throughout which the torrent is all but inaccessible, it reaches the temple of Gangotri, the first work of man on its banks, at an elevation of 10,300 ft., so as to have

descended about 350 ft. in a mile.—*From Gangotri to Hurdwar.*—After a run of 7 m., the stream is joined on the right by the Jahnuvi, considerably larger than itself, in lat. 31° 2′ n., and long. 78° 54′ e.; and the united waters, 13 m. further down, burst through the Himalaya proper, in lat. 30° 59′ n., and long. 78° 45′ east. Still 90 m. lower, it receives the Aluknanda with a volume one half greater than its own, and here it first receives the name Ganges. A distance of 47 m. more carries the still rapid current down to Hurdwar, on the verge of the great plain of Hindustan, at an elevation of 1024 ft., showing a descent of 9,276 ft. in 157 m., or of nearly 60 ft. in a mile.—*From Hurdwar to Allahabad.*—This portion of the river, measuring 488 m., and averaging a fall of 22 in. in a mile, is beset almost throughout by shoals and rapids. It is navigable, however, for river-craft the whole way to Hurdwar, for passenger-steamers to within 100 m. of the mountains, and for loaded barges up to Cawnpore, which is 140 m. above Allahabad. This last-mentioned city stands at the confluence of the G. and the Jumna.—*From Allahabad to Seebgunge, or the head of the Delta.*—This, the longest of the five divisions of the stream, measures 563 m. in length, and has a fall of about 5 in. in a mile. Notwithstanding many shoals, it is practicable throughout, even in the driest season of the year, for vessels drawing fully 18 inches. About 270 m. below Allahabad, the G. is joined on the left by the Ghogra, having previously received the Gumti on the same side, and the Tons and the Kurumnassa on the right. About half-way between Allahabad and the Ghogra is the city of Benares. Between the Ghogra and Seebgunge, the principal affluents are the Sone on the right, and the Gunduk and the Coosy, or Sun Kosi, on the left. Along this entire section, the G. varies largely both in breadth and in depth, according to the season of the year and the state of the water.—*From Seebgunge, or the head of the Delta, to the Bay of Bengal.*—Here the descent, along a line of 283 m., averages about 3 in. in a mile. Hitherto swollen by its feeders, the G. now begins to send off branches, parting at Seebgunge with the Bhagrutti, and next, 70 m. further down, with the Jellinghi, at the town of the same name, which, after separate courses for about 120 m. each, unite to form the Hoogly of Calcutta. Below the point of departure of the Jellinghi, it throws out similar offsets, the Marabhanga, the Gorae, the Chundni, and the Kirtynassa. Meanwhile, this waste towards the right is in a great measure compensated by affluents on the left, more especially by various channels of the Brahmaputra—the two great net-works of waters intertwining themselves together in a manner too complex for delineation, and at last indenting a long line of coast with at least 20 estuaries. The mouth of the Hoogly, the most available of all the branches of the G. as the means of communicating with the outside world, is in lat. 21° 40′ n., and long. 88° east. By it the largest ships reach Diamond harbor, while vessels of considerable burden ascend to Chandernagore. Between the Hoogly and the G., above the Delta, there are two routes. When the water is high, the Bhagrutti and the Jellinghi afford the requisite facilities; but in the dry season, the intercourse is maintained by the Sunderbund or Sunderbans passage, a circuitous course to the n.e., which opens into the Chundni.

As a whole, however, the G. is incapable of being definitely described. It varies not merely from season to season, but also from year to year. From year to year it exchanges old passages for new ones, more particularly in the alluvial basin of its lower sections. Even as far up as Futtehpore, immediately above Allahabad, this characteristic is remarkably exemplified. The river has in this part a bed of the average width of 4 m., within the limits of which it changes its course annually, in the lapse of four or five years shifting from the one limit to the other. Between season and season, again, the fluctuations are still more conspicuous. To take Benares as an instance, the stream ranges, according to the time of the year, from 1400 ft. to 3,000 ft. in breadth, and from 35 ft. to 78 ft. in depth. Lower down, the vicissitudes, without being more striking in themselves, produce more striking results. About the close of July, a considerable proportion of the delta forms an inundation of more than 100 m. in diameter, presenting nothing to the eye but villages and trees, and craft of every sort. To prevent or mitigate this evil, expensive dams have been constructed, having collectively a length of above 1000 miles. The influence of the tides extends, at the dry season, a distance of 240 m. from the sea. The minimum quantity of water delivered per second has been estimated at 36,330 cubic ft., and the maximum at 494,208 cubic feet. Like all rivers that overflow their banks, the G. holds in suspension a large admixture of mud and sand —foreign elements eminently unfavorable to steam-navigation, as causing quick wear and decay of the cocks and valves of the engines. It has been computed that it delivers, on an average, annually into the sea 534,600,000 tons of solid matter.

Amongst the rivers which at the *classical* and the *Purânic* period of India were held in peculiar sanctity by the nation, the G.—or, as it is called, the *Gangâ* (feminine)— undoubtedly occupied the foremost rank. In the vedic poetry, it is but seldom mentioned; and whenever its name occurs, whether in the hymns of the *Rigveda* or the ritual text of the *Yajurveda*, no legendary fact or mythical narrative is connected with it. Nor does the law-book of Manu justify the conclusion that its author was acquainted with any of the myths which connect this river in the epic poems and in the Purânas with the Pantheon of India. The earliest, and by far the most poetical legend of the G., occurs in that masterpiece of Sanscrit poetry, the *Râmâyana*. We give its substance, because it explains the principal epithets by which this river is spoken of, or invoked,

in ancient and modern Hindoo poetry, and because it may be looked upon as the type of the many fables which refer to the purifying and supernatural properties of its waters. There lived, says the *Râmâyana*, in Ayodhyâ (the modern Oude), a king, by the name of Sagara, who had two wives, Kesinî and Sumati; but they bore him no issue. He therefore repaired to the Himalaya; and after a hundred years' severe austerities, Bhrigu, the saint, became favorable to his wishes, and granted him posterity. Kesinî bore him a son, who was named Asamanjas, and Sumati brought forth a gourd, whence sprang 60,000 sons, who in time became as many heroes. Asamanjas, however, in growing up, was addicted to cruel practices, and was therefore banished by his father from the kingdom. His son was Ansumat, who thus became heir to the throne of Ayodhyâ. Now, it happened that Sagara resolved to perform a great horse-sacrifice; and in accordance with the sacred law, chose for this purpose a beautiful horse, which he confided to the care of Ansumat. But while the latter was engaged in the initiatory rites of the sacrifice, a huge serpent emerged from the soil, and carried off the horse to the infernal regions. Thereupon, Sagara, being informed of the obstruction which had befallen his pious undertaking, ordered his 60,000 sons to recover the horse from the subterranean robber. These then set to work, digging the earth, and striking terror into all creation. Having explored, for many years, the infernal regions, they at last found the sacred horse grazing, and watched by a fiery saint, in whom they recognized the serpent, the cause of their troubles. Enraged, they attacked him; but the saint, who was no other being than Vishnu, at once reduced them to ashes. Waiting in vain for the return of his sons, Sagarà sent his grandson, Ansumat, in search of them and the sacred horse. Ansumat went, and soon ascertained the fate of his relatives; but when—mindful of his duties—he wished to sprinkle consecrated water on their ashes, so as to enable their souls to rise to heaven, Garuda, the bird of Vishnu, and brother of Sumati, came in sight, and told Ansumat that it was improper for him to use terrestrial water for such a libation, and that he ought to provide the water of the Gangâ, the heavenly daughter of Himavat (the Himalaya). Ansumat, bowing to the behest of the king of birds, went home with the horse to Sagara; and the sacrifice being achieved, Sagara strove to cause the descent of the Gangâ, but all his devices remained fruitless; and after 30,000 years, he went to heaven. Nor was Ansumat more successful in his attempt with the austerities he performed for the same purpose, nor his son Dwilîpa, who, obeying the law of time, after 30,000 years, went to the heaven of Indra. Dwilîpa had obtained a son, named Bhagîratha. He, too, was eager to obtain the descent of the Gangâ; and having completed a course of severe austerities, he obtained the favor of Brahman, who told him he would yield to his prayers, provided that Siva consented to receive the sacred river on his head, as the earth would be too feeble to bear its fall when coming from heaven. And now Bhagîratha recommenced his penance, until Siva consented, and told the Gangâ to descend from heaven. The river obeyed; but, enraged at his command, she assumed a form of immense size, and increased her celerity, thinking thus to carry him off to the infernal regions. Yet the god becoming aware of her intentions, caught and entangled her in his matted hair, out of which she could find no means of extricating herself though erring there for many years. Nor would she have been released, had not Bhagîratha, by his renewed penance, appeased the god, who then allowed her to descend from his head in seven streams—Hlâdinî, Pâvinî, and Nalinî, which went eastwards; and Sîtâ, Suchakshus, and Sindhu, which went westwards, whilst the seventh stream followed Bhagîratha wherever he proceeded. But it so happened that the king on his journey passed by the hermitage of an irascible saint whose name was Jahnu. The latter seeing the Gangâ overflooding in her arrogance the precincts of his sacrificial spot, and destroying his sacred vessels, became impatient, and drank up all her waters; thereupon all the gods became terrified, and promised him that, in future, the Gangâ would pay him filial respect, and become his daughter, if he would restore her again to existence. Quieted by this promise, Jahnu then allowed her to flow out from his ear, and therefore she is still called Jâhnavî, or the daughter of Jahnu. But, because Bhagîratha, by dint of his exertions, enabled his ancestors, now sprinkled with the waters of the Gangâ, to ascend to heaven, Brahman allowed him to consider her as his daughter, whence she is called Bhâgîrathî. And she is also called the river of "the three paths," because her waters flow in heaven, on earth, and pervaded the subterranean regions.—Such is the account of the *Râmâyana*, and its substance is repeated by the *Mahâbhârata* and several of the Purânas, though they differ in the names of the streams formed in her descent by the Gangâ, some (for instance, the *Vishnu-* and *Vâyu-Purâna*) restricting their number from seven to four, called by the *Vishnu-Purâna* Sitâ, Alakanandâ, Chakshu, and Bhadrâ. A further deviation from the original myth was caused by sectarian influence; for, whereas in the *Râmâyana*, the Gangâ springs from the Himavat (Himalaya), whose daughter, therefore, she is, and whereas Siva plays the most prominent part in her descent to earth, the *Vishnu-Purâna* assigns her source to the nail of the great toe of Vishnu's left foot, and allows Siva merely to receive one of her branches on his head. The following passage from this Purâna will show the ideas of the Vishnuite sect on the history and the properties of this river: "From that third region of the atmosphere, or seat of Vishnu, proceeds the stream that washes away all sin, the river Gangâ, embrowned with the unguents of the nymphs of heaven, who have sported in her waters. Having her source in the nail of the great toe of Vishnu's

left foot, Dhruva (Siva) reverses her, and sustains her day and night devoutly on his head, and thence the seven Rishis practice the exercises of austerity in her waters, wreathing their braided locks with her waves. The orb of the moon, encompassed by her accumulated current, derives augmented luster from her contact. Falling from on high, as she issues from the moon, she alights on the summit of Meru, and thence flows to the four quarters of the earth, for its purification. The Sîtâ, Alakanandâ, Chakshu, and Bhadrâ, are four branches of but one river, divided according to the regions towards which it proceeds. The branch that is known as Alakanandâ was borne affectionately by Siva, upon his head, for more than a hundred years, and was the river which raised to heaven the sinful sons of Sagara by washing their ashes. The offenses of any man who bathes in this river are immediately expiated, and unprecedented virtue is engendered. Its waters, offered by sons to their ancestors in faith for three years, yield to the latter rarely attainable gratification. Men of the twice-born orders, who offer sacrifices in this river to the lord of sacrifice, Purushottama, obtain whatever they desire, either here or in heaven. Saints who are purified from all evil by bathing in its waters, and whose minds are intent on Kesava (Vishnu), acquire thereby final liberation. This sacred stream, heard of, desired, seen, touched, bathed in, or hymned day by day, sactifies all beings; and those who, even at a distance of a hundred leagues, exclaim 'Gangâ, Gangâ,' atone for the sins committed during three previous lives." How far the belief expressed in the latter passage was carried at a period probably succeeding that of the composition of the *Vishnu-Purâna* may be seen from a legend which occurs in the *Kriyâyogasâra*, the sixth division of the *Padma-Purâna*. This Purâna relates that a king, Manobhadra, having grown old and weak, resolved upon dividing his kingdom between his two sons. He therefore convoked a council of his ministers, when, of a sudden, a vulture and his mate flew into the hall, to the surprise of the whole assembly. Questioned about the purpose of their visit, they replied that, having witnessed the evil luck of the two princes in a former birth, they now came to rejoice in their happiness. The king's curiosity having been roused, the male vulture then said, that in the age called Dwâpara, the two princes had been two men of low caste, called Gara and Sangara, and when dead, were brought before Yama, the judge of the dead, who sentenced them to be thrown into a fearful hell. Their lives had indeed been faultless; no sin had been committed by them, but whenever they gave alms they did not offer them to a Brâhmana, and thus robbing the latter of the property which otherwise would have come to him, they became candidates for hell. He, the vulture, had come to the same place, because, when being a noble Brâhmana, Sarvasa, he slighted his parents. Now the period of their sentence having expired, he was reborn as a member of the vulture tribe, which is living on the flesh of the dead, whereas they became a couple of locusts. Once, however, a hurricane arose, and threw the locusts into the G.; there they died; but having found their death in the water of the river which destroys all guilt, the servants of Vishnu came with heavenly chariots to conduct them to his town. Having stayed there up to the end of the third Kalpa, they were bidden by Brahman to enjoy themselves in the paradise of Indra; and after a certain time they were reborn in the family of Manobhadra, ultimately to rule his country. All the hymns addressed to the G.—and a remarkable one occurs in the same division of the *Padma-Purâna*—partly allude to the legends mentioned before, or to other feats of purification worked by the sacred water of this river. Its efficacy is deemed, however, greatest at the spot where the G. joins the Yamunâ, or Jumna, at Allahabad, and—the latter river having previously received the Saraswati below Delhi—where in reality the waters of the three sacred rivers meet. In some representations of Siva, the Gangâ is seen in his hair, and the river issuing from her mouth; she is also pictured, as Moor tells in the *Hindu Pantheon*, as part of the *Triveni* or sacred triad of the rivers just named, when she is white, and bears the forehead mark of Siva; on her right is Saraswatî, red, and with a roll of paper in her hand; on her left, Yamunâ, as Lakshmî, the deity of this river, blue, and holding a golden jar. The whole group is riding on a fish; the fish, the clothing of the goddesses, and the glory encircling their heads, being of gold.—Gangâ is also considered as the mother of the god of war. See Kârtikeya.

GANGES CANAL, a modern imitation, in some measure, of the more ancient works of the kind on the Jumna (q.v.), has two main objects in view—the irrigating of the Doab, and the avoiding of the difficulties in the navigation of the river above Cawnpore. Extending, on the right of the Ganges, from Hurdwar to the city last mentioned, it measures, including its branches, 810 m.—350 for the trunk, and 460 for the offsets. In its course, it crosses the Solani on perhaps the most magnificent aqueduct in the world. This noble work, erected at a cost of £300,000, consists of 15 arches, each having a span of 50 ft.; while the piers, sunk 20 ft. below the bed of the stream, are protected on every side against the force of the current by ingeniously compacted masses of piles and stones.

GANGI, a t. of Sicily, in the province of Palermo, 53 m. s.e. from Palermo. It occupies the summit and slopes of a steep and lofty hill. The old town of G. was destroyed in 1299 by Frederick II. One of the best Sicilian painters of the 17th c., Giuseppe Salerno, was born here. One of the churches contains a much-admired painting of the "Last Judgment," from his hand. Pop. 12,600.

GANGLION, in anatomy. See Brain and Nervous System.

GANGO'TRI, a temple erected on the highest accessible spot on the Ganges (q.v.), about 10,000 ft. above the level of the sea, stands on the right bank of the river, here called the Bhagirathi, about 10 m. from its source. Immediately in front, the stream expands into a small bay, which is subdivided into pools, taking their names respectively from Brahma, Vishnu, and other gods of the native mythology. Though the water is specially sacred, and ablution peculiarly efficacious, yet, from various causes, the pilgrims are by no means numerous. Besides the length and ruggedness of the journey, and the difficulty of procuring subsistence by the way, there is no accommodation for visitors, the only dwelling-house in the locality being occupied by the officiating Brahmans. Superstition, however, has found a remedy in the exportation of flasks of the holy element, sealed by the attendant priests.

GANGRA, COUNCIL OF, held at Gangra, in Paphlagonia, about 370 A.D., against Eustathius of Sebaste, who was the first preacher of the ascetic life in the countries around Pontus, where his disciples became numerous. He taught that it is unlawful to marry and to eat certain meats; separated several married persons, and advised those who disliked the public offices of the church to communicate at home. He wore, and imposed on his disciples, a distinctive dress, compelled women to cut off their hair, and directed his followers to shun, as profanation, the communion and benediction of a married priest. In opposition to these and similar views, of which some have since been held by the church of Rome, the council published 21 canons condemning those who pronounced marriage unlawful, who forbade the eating of meat, refused to receive the communion at the hands of a married priest, wore a peculiar dress as a mark of unusual strictness, forsook their husbands through a false horror of marriage, and deserted their children or their parents, under pretext of leading an ascetic life.

GAN'GRENE, the loss of vitality in a part of the living body, whether external or internal, the part becoming often, in the first instance, more or less red, hot, and painful, then livid, and finally dark and discolored, black or olive-green, according to circumstances, and putrescent; after which a separation takes place gradually between the living and dead parts, and if the patient survive, the disorganized and lifeless texture is thrown off, and the part heals by the formation of a cicatrix (q.v.) or scar, indicating the loss of substance. Gangrene is an occasional consequence of inflammation (q.v.), but is often also determined by more specific causes, such as typhus fever or erysipelas (q.v.); sometimes, also, by the action of poisons on the system, and not unfrequently by disease or obstruction of the arteries of a part. This last is especially the case in the form called senile gangrene. Gangrene admits only to a slight extent of medical treatment; but there is sometimes a necessity for surgical interference, to preserve a useful stump, or to arrest bleeding. Generally speaking, the strength must be maintained by a nourishing but not too stimulating diet, and the part carefully preserved from external injury, and from changes of temperature.

GANGS, AGRICULTURAL, a name specially given to companies of women, and boys and girls, brought together for labor in the fen-districts of England, or the low and level tracts which lie s. of the Wash in the counties of Lincoln, Cambridge, Norfolk, Suffolk, and Rutland. Not many years ago, the part of the country referred to was a marsh. Dikes and canals have, however, been constructed to drain it, and it has been converted into one of the most fertile agricultural districts of England. It might have been expected that when covered with corn-fields an agricultural population would have spread into it, and that houses would have been erected for their accommodation. This, however, is not the case. English landlords shunned the responsibility incurred under the poor-law, by the erection of houses for laborers. The reclaimed land was accordingly cultivated by laborers from the villages, which are numerous on the high ground that borders it. To save expense, they consisted, as much as possible, of women, girls, and boys. They worked in gangs, and as many as 27,000 persons were so employed. Among the last acts passed at the close of the session 1866–67 was one for the regulation of agricultural gangs. It provided that no woman or child was to be employed in the same gang with men or boys, and that no woman or girl was to be employed in any gang under a male gang-master, unless a woman licensed to act as superintendent was also present with the gang. The act was received with hearty approval in the districts chiefly concerned, and its effect has been most salutary. The inquiry which preceded it led to the appointment of a commission in 1867, to inquire into the employment of children and women in agriculture, with the view of ascertaining how far the principles of the factory acts can be applied to them, and especially with a view to the better education of the children. One result of the evidence obtained was the passing of the agricultural children bill, on Aug. 5, 1873, which directs that no child shall be employed in agriculture under the age of 8; that none shall be employed between the ages of 8 and 10, who cannot produce a certificate of 250 attendances at school in the previous year; and none between the ages of 10 and 13 who cannot produce a certificate of 150 attendances.

GANGUE (Ger. *Gang*, a vein), the stony matrix in which metallic ores occur. Quartz is the most common gangue, but calc-spar is also very frequent, sulphate of barytes and fluor-spar not unfrequent. Large portions of the gangue are generally worked and submitted to metallurgic processes for the sake of their contents.

GANGWAY (Saxon, *gangweg*), the entrance to a ship. There is a gangway on each side, consisting of steps or cleats nailed to the planks of the side, up which, by aid of a rope, it is necessary to climb. When, however, a vessel is in harbor, a portable flight of steps, called an accommodation-ladder, is usually hoisted out, by which the ascent is sufficiently easy.

GAN-HWUY, or NGAN-HWEI, one of the five eastern provinces of China proper. It is intersected by the Yang-tze-kiang, on the left bank of which river its capital, Ngan-king-foo, is situated. In the south-eastern parts of the province are some extensive tea-plantations, and it also produces rice, grain, and a limited quantity of silk. Pop. according to a recent estimate, 36,596,988; area, 50,000 sq. miles.

GANJAM, the district mentioned in the succeeding article, lies on the n.w. coast of the bay of Bengal, immediately to the s. of Cuttack, stretching in n. lat. from 18° 13′ to 19° 52′, and in e. long. from 83° 50′ to 85° 15′, and containing 8,313 sq. miles. Pop. '71, 1,520,088. The chief products are rice, maize, sugar-canes, millet, pulse, oil-seeds, wax, gums, dye-stuffs, and arrow-root. On the northern boundary is the salt-lake Chilka, 42 m. long, 15 broad, and only 6 ft. deep. The country does not offer a single haven to ships of any burden. Small vessels, however, may enter the Rosikoila. From its chief town G. is often called *Chicacole.*

GANJAM′, a t. in the presidency of Madras, stands on the left bank of the Rosikoila, immediately above its entrance into the bay of Bengal, in lat. 19° 23′ n., and long. 85° 7′ e. It was once the capital of the district of its own name, and was remarkable for its fine buildings. But in 1815, when the town was visited by deadly fevers and agues, all the public establishments were removed to Chicacole (q.v.); the fort and cantonments gradually fell into ruin, and the place sank into decay.

GANJEH. See ELIZABETOPOL.

GANNAL, JEAN NICOLAS, 1791–1852; a French chemist. In 1808, he entered the medical department of the French army, and in the campaign of 1812 he witnessed the disastrous retreat from Moscow. After the downfall of the empire he obtained a situation at the école polytechnique in Paris, and subsequently acted as chemical assistant to Thenard. He devised a method for the refining of borax, by which the price of that salt was reduced from 6 francs to 60 centimes per lb. He was the first to introduce into printing the use of elastic rollers, which he formed of a mixture of gelatine and sugar; and his process for the melting of tallow and hardening it with acids prepared the way for the manufacture of wax-candles. His experiments with gelatine demonstrated the incorrectness of the opinion that it possessed highly nutritive properties. He obtained one of the Monthyon prizes of the institute in 1835 for the discovery of the efficacy of injections of solutions of acetate and chloride of aluminium in preserving anatomical preparations. He accomplished embalmment without mutilation of the body, and with economy, by injecting into one of the carotid arteries solutions of aluminium salts.

GANNAT, a t. of France, in the department of Allier, is pleasantly situated on the Andelot, a tributary of the Allier, amid hills covered with vines and timber trees, 34 m. s.s.w. of Moulins. In former times, it was fortified by walls and ditches, the latter tanneries bieing supplied with water by the stream on which the town stands. G. has and breweries, and a trade in corn, wine, and cattle. Pop. '76, 5,042.

GANNET, *Sula*, a genus of web-footed birds, of the family *pelecanidæ*, having a long, strong, conical bill, the face and throat naked, the feet with four toes, three before and one behind, all united by the web. To this genus the booby (q.v.) belongs. Another species of the COMMON G., or SOLAN GOOSE (*S. bassana*), a bird which breeds on insular rocks in the northern seas, and migrates in winter to warmer and even tropical regions. The name *solan* or *soland* goose is from *solent*, an old name of the English channel. The entire length of the G. is about 3 ft.; its general color milk-white, the crown and back of the head pale yellow, the quill-feathers of the wings black. The G. lays usually a single egg, of a chalky white color; the young bird, when newly hatched, has a naked bluish-black skin, but soon becomes covered with a thick white down, so that it resembles a powder-puff, or a mass of cotton; and when the true feathers appear, they are black, with lines and spots of dull white, so that the plumage of the young is very unlike that of the mature bird. The G. is long-lived, and takes about four years to come to maturity. Its motions on land are very awkward; but it is a bird of very powerful wing and graceful flight. It extends its flight to great distances from the rocks which it inhabits, pursuing shoals chiefly of such fish as swim near the surface, particularly herring, pilchards, and others of the same family. The presence of a shoal of pilchards often becomes known to the Cornwall fishermen from the attendant gannets. When feeding, the G. always flies against the wind at an altitude of not more than about 100 ft. above the surface of the sea. When it espies a fish it instantaneously stops, and with wings *half* distended, stoops and swiftly cleaves the air. When within a yard or two of the surface, and just as it makes the plunge, the wings are clapped close to its sides. Thus the bird enters the water like a bolt. The G. is found in every continent; Lundy isle, the Bass Rock, Ailsa, St. Kilda, Suliskerry, and Skelig (Ireland), being the most celebrated British breeding places. The number of gannets that annually visit the Bass Rock in the firth of Forth is estimated at from sixteen to twenty thousand. The

young are killed by cliff-men who are lowered down the rock by a rope; they are valued for the sake of their down, flesh, and oil, which bring a profit to the person who rents the rock. On and around the Bass, gannets are seen in prodigious numbers, the air around the rock being filled with them, like bees around a hive, and the rock itself whitened by them and their accumulated excrements. Their nests are formed of sea-weeds and marine grasses. The G., during incubation, will often allow itself to be touched with a stick without rising from the nest. Its flesh is rank and oily; but that of the young, baked, is eaten to a considerable extent in many places, and is even reckoned a delicacy. The eggs are considered by many connoisseurs to be a decided delicacy. They are boiled for 20 minutes, and eaten cold, with vinegar, salt, and pepper. The voice of the G. is harsh, and the cries of the multitudinous birds, when disturbed at their breeding-places, are deafening. The G. comes to its breeding-places in the beginning of April, and leaves in autumn. A species of G. (*S. variegata*), extremely abundant in some parts of the southern hemisphere, is said to be the chief producer of guano.

GANNETT, Ezra Stiles, d.d., 1801–71; b. Mass.; a graduate of Harvard and Cambridge divinity school; entered the ministry of the Unitarian church and became a colleague of Dr. William E. Channing. He was pastor of the Federal-street church, Boston, which removed subsequently to Arlington street, from 1824 until his death. He was the founder of the *Scripture Interpreter*, edited the *Monthly Miscellany*, and assisted on the *Christian Examiner*. Many of his sermons have been published. He was an earnest preacher, a strong and keen controvertist, an eloquent orator, and a faithful pastor. He was one of the leaders of the earlier or conservative Unitarianism.

GANO, Stephen, 1762–1828; b. New York. He was a surgeon in the continental army. In 1786, he was ordained a minister, and for 30 years had charge of the first Baptist church, Providence, R. I.

GAN'OID FISHES, one of the four orders of fishes in the classification of Agassiz, characterized by *ganoid* scales—shining scales (Gr. *ganos*, splendor), covered with enamel, angular, either rhomboidal or polygonal. Ganoid scales are often large, thick, and bony; they are usually placed in oblique rows, and united to each other by a kind of hook at the anterior angle. Recent ganoid fishes do not form a natural group, but differ in very important parts of their organization. Some of them have an osseous, some a cartilaginous skeleton. Recent G. F. are, however, comparatively few; whereas, among fossil fishes, the ganoid type is extremely prevalent. The sturgeon is an example of a ganoid fish.

GANS, Eduard, 1798–1839; a German jurist, of Jewish descent; the son of a banker, educated at Berlin, Göttingen, and Heidelberg; in 1825, became professor extraordinarius at Berlin. At this period the historical school of jurisprudence was coming to the front, and G., who in philosophy was a strong Hegelian, applied the method to one special branch of legal relations—the right of succession. His great work, *Erbrecht in weltgeschichtlichen Entwicklung*, is still of permanent value, presenting the slow evolution of legal relations. G. had intimate acquaintance with the knot of brilliant writers and lecturers, Cousin, Villemain, Michelet, and Quinet, who then made Paris the center of literary culture and criticism. The liberality of his political views drew the displeasure of the Prussian government, and in 1835 his course of lectures on history of the last fifty years, afterwards published, was prohibited. Beside other published works, G. edited the *Philosophie der Geschichte* in Hegel's *Werke*, and contributed an admirable preface.

GANSEVOORT, Peter, Jr., 1749–1812; b. New York. In 1775, he was appointed major of the 2d New York regiment, and accompanied Montgomery in the invasion of Canada. The following year, having been made lieut.col., he was in command of fort George, and in 1777 defended fort Stanwix against the British and Indian siege, conducted by St. Leger, for three weeks, thus detaining the latter from co-operating with Burgoyne. For this service he received the thanks of congress. He was appointed by the state of New York brig.gen. in 1781, and in 1809 received the same rank in the regular army of the United States. He filled successively the offices of commissioner of Indian affairs, commissioner for fortifying the frontiers, and military agent.

GANT'LET, or Gauntlet (Fr. *gant*, a glove), an iron glove, which formed part of the armor of knights and men-at-arms. The back of the hand was covered with plates jointed together, so as to permit the hand to close. Gantlets were introduced about the 13th century. They were frequently thrown down by way of challenge, like gloves. They are frequently used in heraldry, the fact of their being for the right or left hand being expressed by the words "dexter" or "sinister."

In the phrase "to run the gantlet," the word is probably a corruption for *ganglope* (from *gang*, a passage, and the root occurring in e-*lope*—*D. loopen*, Ger. *laufen*, to run). The German has *gassenlaufen* (lane-run), meaning a military punishment, which consists in making the culprit, naked to the waist, pass repeatedly through a lane formed of two rows of soldiers, each of whom gives him a stroke, as he passes, with a short stick or other similar weapon.

GANTUNG PASS, in lat. 31° 38′ n., and long. 78° 47′ e., leads eastward from Kunawar, a district of Bussahir in Hindustan, into eastern Tartary. Its height is 18,295 ft.

above the sea, and it is overhung by a peak of its own name, about 3,000 ft. loftier. The place is unspeakably desolate and rugged. It is, of course, beset with perpetual snow, and being devoid of fuel, it is but little frequented. Gerard, one of the few travelers that have visited it, crossed it—and that in July—amid snow and sleet. One peculiarity in the scene, according to the traveler just mentioned, is that the whitened surface presents here and there dangerous pools of still water.

GANYME'DES, the cup-bearer of Zeus, was, according to Homer, the son of Tros, or, according to others, of Laomedon, Ilus, or Erichthonius. The most beautiful of mortals, he attracted the notice of the king of the gods, who dispatched his eagle to carry him off to heaven, where he succeeded Hebe in the office above referred to. The Greeks believed that Zeus gave Tros a pair of divine horses as a compensation for kidnapping his boy, and comforted him at the same time by informing him that G. had become immortal and free from all earthly ills. At a later period, G. was identified with the divinity who presided over the sources of the Nile. The Greek astronomers likewise placed him among the stars, under the name of Aquarius (the water-bearer), in allusion to his celestial function. He was also a favorite subject of ancient art.

GAOL. See PRISON.

GAOL DELIVERY, COMMISSION OF, is one of the four commissions issued to judges of assize in England, under which they discharge their duties on circuit. See ASSIZE. Commission of G. D. empowers the judges to try and deliver every prisoner who shall be in the gaol when they arrive at the circuit town. It is directed to the judges, with whom are coupled the sergeants-at-law and queen's counsel on the circuit, the clerk of assize, and the associate. It constitutes the persons to whom it is directed the queen's justices, and orders four, three, or two of them, of whom one must be a judge or sergeant, to proceed to try prisoners. It was anciently the course to issue special writs of goal delivery for each particular prisoner, which were called the writs *de bono et malo;* but these being found inconvenient and oppressive, a general commission for all the prisoners has long been established in their stead (Stephen, *Comm.* iv. 371). It is not incumbent on the commissioners to deliver all the prisoners in the gaol, but they cannot try any one who was not in custody or on bail at the opening of the commission. A commission of G. D. has power to order that the proceedings at any trial shall not be published till all the trials are finished. Violation of this order is contempt of court, and is punishable by fine and imprisonment. At common law, a commission of G. D. is suspended by the court of queen's bench sitting in the same county; but by 25 Geo. III. c. 18, the session at Newgate of oyer and terminer and gaol delivery is not to be interrupted by the commencement of term and sitting of the king's bench at Westminster. By 4 and 5 Will. IV. c. 36, a special court has been created for London and the suburbs, called the central criminal court (q.v.), for which a special commission of G. D. is issued.

GAP, a small t. of France, capital of the department of Hautes Alpes, is pleasantly situated on the right bank of the Luie, about 50 m. s.e. of Grenoble. It is approached through walnut avenues, and surrounded by slopes on which the vine flourishes at the height of 2,558 ft. above sea-level. When seen from a certain distance, the town has a picturesque appearance; but on a closer inspection, it is found to be merely a labyrinth of dirty, narrow, and ill-paved streets. The chief public building is the cathedral, with a mausoleum in marble of the constable de Lesdiguières. The town has manufactures of coarse woolens, linens, agricultural implements, and leather. Pop. '76, 7,249. G., the ancient *Vapincum*, was formerly capital of the district of Dauphiné, to which it gave the name of Gapençois. At the commencement of the 17th c., it is said to have had about 16,000 inhabitants. Since that period, however, it has steadily declined in size and importance. It was sacked and almost wholly reduced to ashes, by Victor Amadeus Savoy in 1692.

GAPES, a disease of gallinaceous birds, owing to the presence of a *trematode* worm (*fasciola trachealis*) in the windpipe. This entozoon, allied to the *fluke* (q.v.), is, however, a creature of very different general form, being a red, wavy, cylindrical worm, tapering at the tail, and forking near the upper extremity, the branch which is sent off terminating in a sucker for adhesion, whilst the mouth terminates the principal trunk. The whole length seldom exceeds an inch. Twenty of these worms, of various sizes, have been found in the windpipe of a single chicken. Pheasants, partridges, etc., are also liable to be infested by them. They produce inflammation, and sometimes suffocation and death. A common remedy is to introduce into the bird's throat the end of a feather, well oiled, and to turn it round, so as to dislodge the worms, which are then either brought out by the feather, or coughed out by the bird. Another cure is to give a little Epsom salts mixed with the food. Urine is often used in the same way. See SCLEROSTOMA.

GARAKONTHIE, DANIEL, d. 1675; the chief of the Onondaga Indians and had great influence in the councils of the five nations, always endeavoring to keep peace with the French, preventing war expeditions, and rescuing prisoners. He embraced Christianity and was baptized by bishop Laval of Quebec in 1670.

GARANCEUX is a term now applied to the rough preparation which was formerly called garancine—namely, the spent madder acted on by sulphuric acid, as mentioned under GARANCINE.

GARANCINE, a manufactured product of madder; hence its name, derived from the French *garance*. The discovery of the process for making this material is due to the French, and it has proved one of the most valuable additions to our dyeing materials that has been made during the present century.

It was first practically used in the dyeing establishment of Messrs. Lagier and Thomas at Avignon, where it was introduced with the hope of turning the spent madder to account; but the rude manner in which it was prepared prevented it from becoming generally used for a long time, and our ignorance of the organic chemistry of madder at first hindered its improvement. It was first prepared by drying and pulverizing or grinding the spent madder which had been used in the ordinary processes of dyeing madder styles; this was then saturated with sulphuric acid, which was supposed to char the woody tissue, and destroy the *alizurine* and some other organic products of the madder, but to have no effect upon the purpurine, which was consequently available for fresh dyeing processes. Subsequent experience showed these views to be wrong, and G. is now prepared for pure ground madder-root which has not previously been used.

For this purpose, the ground madder is mixed with water, and left for a day, and then fresh water is added, and the whole drawn off. By this means, the sugar, and probably the whole of the rubian, another principle of the madder, are dissolved and removed. Sulphuric acid is then added, and the temperature raised to about 90° F. for some hours, after which it is well washed with cold water, strained, pressed, and dried, and afterwards ground. In this state, it has a fine chocolate-brown color, and looks somewhat like ground coffee. The advantages of G. over madder are, that it is more easily used, and the colors it gives are brighter and more intense, although not so permanent.

GARAT, DOMINIQUE JOSEPH, 1749–1833; a French statesman and contributor to newspapers. In 1785, he was named professsor of history at the Paris athenæum, where his lectures enjoyed an equal popularity with those of Laharpe on literature. Possessing strongly optimist views, a mild and irresolute character, and indefinite and changeable convictions, he acted an undignified part in the great political events of the time, and became a tool in carrying out the designs of others. He succeeded Danton as minister of justice in 1792, and in this capacity had intrusted to him what he called the *commission affreuse* of communicating to Louis XVI. his sentence of death. In 1793, he became minister of the interior, and during the reign of terror, he was imprisoned, but received his liberty after the revolution of the 9th Thermidor, and was named minister of public instruction. In 1798, he was appointed ambassador to Naples, and in the following year he became a member of the council of ancients After the revolution of the 18th Brumaire, he was chosen a senator by Napoleon and created a count. During the hundred days he was a member of the chamber of representatives, and strongly opposed the recall of the Bourbons. In 1803, he was chosen a member of the institute of France, but after the restoration of Louis XVIII. his name was, in 1816, removed from the list of members. After the revolution of 1830, he was named a member of the new academy of moral and political science. His writings are characterized by elegance, grace, and variety of style, and by the highest rhetorical eloquence; but his grasp of his subject is superficial, and as his criticisms have no root in fixed and philosophical principles they are not unfrequently whimsical and inconsistent. He must not be confounded with his elder brother Dominique, 1735–99, also a deputy to the states-general.

GARAY, JÁNOS, a distinguished Hungarian poet, was b. at Szegszárd in 1812. G.'s poetical genius manifested itself from early boyhood; for it was noticed by his teachers, that whenever he had to make a school *pensum* of Latin verses, he would usually bring at the same time an elaborate Magyar version. His *Csatár* (the Warrior) was published in 1834, and from that moment till his death, G. was one of the most assiduous workmen in the field of Hungarian literature, being attached in succession to the editorial staffs of the *Regélöi*, *Rajzolatok*, *Hirnök*, and *Jelenkor*. G.'s dramatic works are—*Csáb*, a tragedy in five acts (1835); *Arbocz*, a tragedy in five acts (1837); *Orszagh Ilona*, an historical drama in three acts (1837); *Utolsó Magyar Khan*, a tragedy in five acts; *Báthory Erzebet*, an historical drama in five acts. The first complete edition of G.'s poetical works was published at Pesth in 1843. A collection of tales appeared under the title of *Tollrajzok* in 1845; and the historical legends of Hungary, under the title of *Arpádok*, in 1847. A new series of poetry, under the title *Balatoni Kagylók*, was published in 1848. He died at Pesth, Nov. 5, 1853. His last work was *Szent László*, a long historical poem in 12 cantos (2 vols., Erlau, 1850). A complete edition of his poems was published after his death by Franz Ney (Pesth, 1853); and a select number of them have been translated into German by Kertbeny (Pesth, 1854; 2d edit., Vienna, 1857).

GARB, or GARBE (Fr. *gerbe*, Ger. *garbe*), a sheaf of any kind of grain. A G. is frequently used in heraldry. If it is blazoned a G. simply, then wheat is understood; if any other kind of grain is intended, it must be mentioned—e.g., "a garb of oats."

GARBLERS—GARBLE (Fr. *garber*, to make clean). To garble signifies to sever and divide the good and sufficient from the bad and insufficient. Garbles signify the dust or soil that is severed. By 1 Rich. III. it was provided that no bow-staves should be sold ungarbled; and by 12 Ed. IV. c. 2, is enacted that bow-staves be searched and surveyed, and that such as be not good and sufficient be marked. 1 James I. c. 19 was passed to preserve the purity of drugs. By this statute, 32 kinds of drugs are specified as garbleable; and it was declared that all these drugs, etc., were to be garbled and sealed by the garbler before sale, on pain of forfeiture of the same or the value thereof. Power was given to an officer, called the garbler, at all times of the day to enter into any shops, warehouses, or cellars, to view and search for such drugs and spices, and to garble and make clean the same. This statute was repealed by 6 Anne, c. 16; but a similar power to that exercised by the garblers is, by 55 Geo. III. c. 194, now reposed in the apothecaries' hall of London.

GARBO, RAFFAELLINO DEL, 1466–1524; a Florentine painter, a pupil of Filippino Lippi, with whom he remained till 1490, or later. Showing great facility in design, he excited hopes which he did not fulfill. He married and had a large family; embarrassments and careless work ensued, and finally he lapsed into a dejected and penurious condition. Three of his best *tempera* pictures are in the Berlin gallery; one of the Madonna standing with her infant between two musician-angels is particularly attractive. His oil-painting of the "Resurrection" done for the church of Monte Oliveto, Florence, now in the academy of the same city, is ordinarily reputed his masterpiece. Angelo Allori was his pupil,

GARCIA, MANUEL, a well-known musical genius, was b. at Seville, in Spain, in 1775. After acquiring a considerable reputation as a singer in Cadiz and Madrid, he went to Paris in 1808, where he obtained great success at the Italian opera; and in 1811 proceeded to Italy, where he was received with equal favor in Turin, Rome, and Naples. From 1816 to 1824, he was constantly engaged as a singer, either in Paris or London. Subsequently, with a select operatic company, composed in part of members of his own family, he crossed the Atlantic, and visited New York and Mexico. On the road between Mexico and Vera Cruz, he was robbed of all his money; and after his return to Paris, he was compelled to open a class for singing, as his voice had become greatly impaired by age and fatigue. Many of G.'s pupils reached a high degree of excellence, but none equaled his eldest daughter Maria, afterwards Madame Malibran (q.v.). He was less successful as a composer, although several of his works, especially *El Poeta Calculista* and *Il Califo di Bagdad*, were much admired. G. died at Paris in June, 1832.—PAULINE VIARDOT-GARCIA, second daughter of Manuel, was born at Paris in 1821. She has also acquired a great reputation as an operatic singer.

GARCILA'SO, surnamed (by himself) the *Inca*, was b. at Cuzco, Peru, in 1540. He was the son of Garcilaso de la Vega, who belonged to the same family as the poet of that name, and who was one of the conquerors of Peru. G.'s father married Elizabeth Palla, a princess of the race of the Incas, and niece of the famous Huayna Capac, the last emperor of Peru, and G., though a Spaniard and a Christian, was exceedingly proud of the royal blood which flowed in his mother's veins. At the age of 20 he proceeded to Spain, and never again visited America. During the greater portion of his life he lived at Cordova, where he died in 1616. His first work was a *History of Florida* (*La Florida del Ynca*. Lisbon, 1605). It contains an account of the conquest of the country by Fernando de Soto. In 1609 appeared the first, and in 1616, shortly before his death, the second part of his work on the *History of Peru*, entitled *Commentarios Reales que tratan del Origen de los Incas de sus Leyes y Gobierno*. This work is valuable, not so much for any great historical talent which it betokens in the author, as on account of its being almost the only source of information which we possess concerning the ancient Peruvians. G. well understood his mother-tongue, and was thus enabled to correct the errors which other Spanish writers had fallen into from ignorance of the Peruvian language. G.'s *History of Peru* was translated into English by sir Paul Rycaut (Lond. 1688); and into French (2 vols. Amsterdam, 1727).

GARCILA'SO DE LA VEGA, a Spanish soldier and poet, was b. at Toledo, in 1500 or 1503. He early adopted the profession of arms, and gained a distinguished reputation for bravery in the wars carried on by the emperor Charles V. against the French and Turks, but was mortally wounded while storming a castle near Fréjus, in the s. of France, and died at Nice, Nov., 1536, in the 33d year of his age. G., though prematurely cut off, lived long enough to win immortality, and though he wrote little, he revolutionized the national poetic taste of his countrymen. For the short meter of the older romances and redondillas, he substituted the hendecasyllabic verse of the Italians. His pieces consist of only 37 sonnets, 5 *canzones*, 2 elegies, 1 epistle, and 3 pastorals. Singular to say, they do not contain a trace of military ardor, but are inspired by a tender sweetness and melancholy which appear to have deeply affected his countrymen. "His sonnets," says Ticknor, in his *History of Spanish Literature*, "were heard everywhere; his eclogues were acted like popular dramas. The greatest geniuses of his nation express for him a reverence they show to none of his predecessors. Lope de Vega imitates him in every possible way; Cervantes praises him more than he does any other poet, and cites him oftener. And thus G. has come down to us enjoying a gen-

eral admiration, such as is hardly given to any other Spanish poet, and to none that lived before his time." The best of the numerous editions of G.'s poems is that by Azara (Madrid, 1765). They have also been translated into English by Wiffen (Lond. 1823).

GARCI'NIA. See MANGOSTEEN.

GARD, a department in the s. of France, bounded on the e. by the river Rhone, is triangular in shape, its southern extremity reaching into the Mediterranean in a headland which has a coast-line of about 10 miles. It has an area of 2,250 sq.m., and in 1876 a pop. of 423,804. One third of the area is arable, one third waste land, and the remainder occupied by forests, plantations, vineyards, and, on the coast, by extensive and unhealthy marshes. It is watered mainly by the Rhone, and by its tributaries, the Gard—from which the department has its name—and the Ceze. Of its surface, the n.w. is occupied by a branch of the Cevennes; the remainder slopes toward the Rhone and the Mediterranean. The soil is in general dry, the best land occurring in the river-valleys. Coal is found in several places, and salt-works are extensively carried on in the south. The vine (which yields about 26,400,000 gallons of wine annually), the olive, and the mulberry are the principal products. The chief manufactures are silk, woolen, and cotton goods; hats, ribbons, gloves, etc. Wine is largely exported. The department is divided into the four arrondissements of Nîmes, Alais, Uzès, and Le Vigan; the chief town is Nîmes.

GARDA, LAGO DI, one of the most remarkable of the Alpine lakes, and the largest in Italy, was the Lacus Benacus of the Romans. Its modern name is derived from the small village of Garda, situated on its eastern shore, and containing 3,000 inhabitants. G.'s chief tributary is the river Sarca, which rises from the glacier of Monte Adamo, but it also receives several smaller streams descending from the valleys of Ledro, Tavalo, and Vesta. The northern extremity of the lake enters the territory of Trent in the Italian Tyrol. On the e., it has the province of Verona; on the w., that of Brescia; and on the s., that of Mantua. Its greatest length, from Riva to Peschiera, is 32 m.; and its breadth, from Desenzano to Garda, 10 miles. Its depth is very variable; the average generally exceeds 120 ft.; in the direction of Mallesine, it reaches 700 and 800 ft.; and its maximum, as yet ascertained, is 950 English feet. The principal islands are Trimelone, Olivé, and St. Pietro. The scenery is grand. Alpine spurs border the lake on both sides, and descend steeply to its shores, but contain within themselves also many beautiful and fertile valleys. The waters of this lake are remarkably clear, and abound in fish of various kinds. Owing to the extent of its surface, and the violent winds to which it is exposed, waves often rise on it to a considerable height, giving its waters the appearance of a rough sea. The only outlet is the river Mincio at Peschiera, which descends to Mantua, and discharges itself into the Po. The mild climate in the district of the lake, and the beauty of its vicinity, have caused its shores to be lined with beautiful villas. Especially attractive to the scholar is the neck of land called *Sermione* (the *Sirmio* of Catullus), where the remains of that poet's country-house are still traceable. After the peace of Villafranca, lake G. formed the barrier which separated Venetia from the kingdom of Italy.

GARDAI'A, or GHARDEIA, an important trading t. in Algeria, of the Sahara, chief town and seat of the Djemmâa, or elective council of the republic of the seven cities of the Mzab district, is situated amid savagely naked and rocky mountains, in lat. 32° 28' n. and long. 4° 38' e., 312 m. in direct line s.s.e. of Algiers. It is fortified by an inclosing wall, surmounted by 9 towers, and pierced by 10 gates; contains 6 mosques, one remarkable for its size; and has a flourishing trade by means of caravans with Tunis, Algiers, Fez, Morocco, Súdan, and Timbuctoo, in slaves, dates, barley, pottery, provisions, oil, wool, cotton, indigo, leather, gold-dust, ivory, and all the varied raw produce of central and northern Africa. G. is surrounded by extensive orchards, irrigated from wells, some of which are 900 ft. deep. In the vicinity are the ruins of a tower, supposed to have belonged to the Romans. The Mzab republic or confederacy pays to the French an annual tribute of 30,000 francs, 14,000 francs of which are contributed by G. alone. In return for this, the French secure them from all wars and marauders, and open to them freely the markets of the Tell, or coast regions of Algeria. Pop., 13,000. See the *Great Sahara, Wanderings South of the Atlas Mountains*, by H. B. Tristram (London, 1860).

GARDANT, in heraldry, is said of an animal which is represented full-faced, and looking forward. See PASSANT-GARDANT.

GARDELEGEN, a small t. of Prussian Saxony, is situated about 30 m. n.n.w. of Magdeburg, on the Milde. It has manufactures of leather, several mills and distilleries, and five annual fairs. Pop. '75, 6,393. G. is very old. Tradition says that in ancient times it was called Isenburg (*Castrum Isidis*), from being a sanctuary of the goddess Isis, and that it was destroyed by the Franks. Be this as it may, it was certainly destroyed by a duke Dervan in 633 A.D., and rebuilt about 924. Subsequently, for a long period, it was the seat of princely markgrafs, who were called counts of Gardelegen. Until 1478, it remained a free town.

GARDEN, ALEXANDER, 1728–92; b. Scotland; physician and naturalist; studied in Aberdeen under Dr. Gregory, and took up his residence in Charleston, S. C., where he

gained fortune and reputation. He was a correspondent of Linnæus, and author of a number of scientific papers on botany and animals.

GARDEN, ALEXANDER, 1757–1829; b. S. C. He was aide-de-camp to gen. Greene, and author of anecdotes of the revolution, with sketches of distinguished persons of the southern states in that period.

GARDE NATIONALE, the celebrated burgher defenders of order in Paris and certain other French towns, was for the first time introduced into Paris during the revolution of 1789. It had existed for a long time previous in some of the French towns, having been at first employed to defend the rights and privileges of the city, and subsequently to guard the persons and property of the citizens. When, in July, 1789, the entire lower orders of the capital rose and demanded arms, the leaders of the revolution, sitting at the Hôtel de Ville, seized the opportunity to decree, without consulting the government, the formation of a national guard for Paris of 48,000 citizens, which, in the first instance, they named the Parisian militia. Each electoral district was to enroll a battalion of 800 men, divided into 4 companies of 200 men each, 15 of these companies forming a legion. The officers of the battalions were to be elected by the privates; but the higher officers were named by the committee. The device chosen as the badge of the service was of blue and red, the colors of the city, to which white, the color of the army, was added, to denote the intimate union which should subsist between the defenders af national liberty and the military. Thus arose the celebrated tricolor, afterwards adopted as the national badge, and now borne in honor wherever the French name extends. On the king consenting to the removal of the regular troops from Paris, Lafayette (q.v.) was named commandant of the national guard of the city. Ere many more days had elapsed, the friends of municipal freedom had organized themselves into burgher troops in every important town, and the national guard had become a recognized institution of the whole kingdom, the entire number raised being not under 300,000. The force soon acquired an extraordinary degree of discipline and efficiency—in a great degree from the number of old soldiers who, having deserted the crown, were elected to commissions by the municipal troops.

Throughout 1789, the national guard looked on supinely at the excesses of the democratic party in the provinces, and joined the mob in Paris during the atrocities of Oct. 5; but, under Lafayette, better counsels prevailed, and the national army restored order, rescuing the royal family on Oct. 11. For some months after this time, the national guard firmly withstood the more violent insurrectionists, who would have deluged the capital with blood; but irresolution and indecision marked their actions in Aug., 1792, and they stood tamely by during the appalling massacres in the prisons. As the revolution held its sanguinary course, the national guard receded more and more from the moderate views which it had at first supported, until, in 1794, we find it among the most devoted adherents of Robespierre and his bloody triumvirate, ever ready to lend its aid to the execution of their merciless decrees. Later in the year, however, when the reign of terror stood balanced between power and death, the national guard proved, under the command of Barras, faithful to the convention, which had deposed Robespierre and his terrible colleagues. In 1795, the national guard aided in the disarmament of the populace; the reign of the multitude ceased, and the force itself was thoroughly reorganized, all elements of internal turbulence being carefully excluded from its ranks. Under this constitution, none were eligible to serve as national guards but citizens of substance, laborers and the lowest classes being deemed dangerous. Not many months after, so great was the reaction, that the corps had become quite royalist in its feelings, carrying their sympathies at length to open rebellion against the convention; but they sustained an utter defeat from a small body of troops of the regular army, who, under Barras and Napoleon Bonaparte, defended the convention. After this reverse, the national guard ceased practically to exist. It is worthy of remark, however, that in 1794 the latter general had been offered the command of the national guard by Robespierre, and had declined it: had he accepted, how different might have been the fate of Europe!

In 1805, on the eve of the great continental campaign, which he expected would denude France of its regular troops, Napoleon reinstituted the G. N., taking care, however, that no elective or democratic principles should pervade the body. By a decree of Sept. 23, in which the whole empire was included, every man in good health was required to serve, between the ages of 21 and 60: the officers were to be named by the emperor. The companies were localized among the villages and townships; ten companies formed a cohort, and several cohorts, according to the district, formed a legion. This force was maintained in succeeding years in discipline and efficiency; and in 1812, before the great Russian campaign, the emperor placed a large portion of the national guard on permanent duty. He reaped the advantages of this step when, in 1813, after the disastrous issue of that year's warfare, he found 100,000 well-drilled steady troops ready to replace his lost veterans, and fill some of the vacancies in the ranks. In 1814—when advancing to meet the allies, he parted from his empress and his son, the little king of Rome, for the last time—Napoleon solemnly committed them to the protection of the national guard of Paris. After the Bourbon restoration, the national guard continued an important body in the state until 1827, when, its attitude

becoming insubordinate, Charles X. dissolved it, but neglected to *disarm* the members. Enraged at this slight, these men were among his most formidable opponents at the revolution of 1830. Under Louis Philippe, in that year, the G. N. was re-established throughout France, Lafayette being appointed to the command-in-chief, a post, however, from which he was removed shortly afterwards, as his power became dangerously great. In 1831, the national guard of Lyon was implicated in the insurrection there: and in the following year, a considerable portion of the urban legions of Paris took part in the sanguinary disturbances of the Quartier St. Meri, in which, however, they were overcome by the firmness and fidelity of the suburban legions of the *banlieu*. Feeling its power over the citizen king of its own creation, the national guard verged more and more towards republican principles, until, in the critical moments of the reform insurrection of 1848, the guard of the capital deserted from Louis Philippe to the revolutionists, and so put an end to the Orleans dynasty. In the troubles of the spring and summer of 1848, the G. N.—a few legions, subsequently dissolved, excepted—steadfastly supported order, and opposed the socialists. On the election of Louis Napoleon to the presidency, he found it necessary to dissolve the guards in 153 communes; and he reorganized the remainder on a footing to insure the absence of socialistic views.

By an ordinance of June, 1851, the G. N. was placed nearly on the footing of Louis Philippe's reign; but by a decree of 1852, which held till Sept. 4, 1870, the entire force was dissolved, and reformed on a more military basis, in certain departments only. During the Franco-Prussian war, the G. N. was divided into sedentary and active battalions. After the defeat of the commune, in 1871, the French national assembly decreed to dissolve the G. N., leaving the prefects of departments to choose the time of executing the decree. At present this body may be considered abolished, as its existence is incompatible with a new law of recruiting.

GARDEN CITY, a village on Long island founded by the late Alexander T. Stewart. It is on Hempstead plains, about 18 m. from New York *viâ* the Long Island railway. The land was originally a part of a large, sandy plain, and after its purchase by Mr. Stewart from the village of Hempstead, it was graded, drained, and laid out in a village surrounding an open plaza. There is a first-class hotel bearing the name of the city, and a number of pretty cottages, the whole having the appearance of a toy village spread out on a table. Gas and water works have been constructed, and a large portion of the adjoining land is farmed by the estate. It is now the cathedral city of the Prot. Episcopal diocese of Long island, and a noble cathedral and bishop's residence are being built by Mrs. Stewart as a memorial of her husband. The building, of sandstone, in Gothic architecture, is now rapidly approaching completion. There are also grand structures for collegiate, academic, benevolent, and ecclesiastical purposes, to be grouped around the cathedral. See CATHEDRAL. The Queen's county hunt have their kennels near Garden City, on a farm belonging to Mrs. Stewart, and the hunt dinners usually take place at the hotel. The population as yet is not large; rents are low, to approved applicants only. It is reached by train from Hunter's point (ferries from Pine st., James slip, e. 7th, and e. 34th sts.) almost hourly during the day.

GARDE'NIA, a genus of trees and shrubs, of the natural order *cinchonaceæ*, natives of tropical and sub-tropical countries, many of which are now favorites in our greenhouses and hot-houses, on account of their beautiful and fragrant flowers. Some of them are hardy enough to endure the open air in summer. The corolla is funnel-shaped, or approaching to salver-shaped, the tube much longer than the calyx; the fruit is a berry crowned with the calyx. *G. florida* and *G. radicans* are among the species best known in Britain, and bear the name of cape jasmine, but are natives of Japan. The fruit of the former, which is about the size of a pigeon's egg and orange-colored, is sold in the shops of China and Japan for dyeing silks yellow. A beautiful yellow resin exudes from wounds in the bark of *G. arborea* and *G. gummifera*, Indian species. The wood of *G. Thunbergii* and *G. Rothmannia* is very hard, and is used for agricultural implements, wheel axles, etc., at the cape of Good Hope. Both of these species are known in Britain as esteemed hot-house plants.

GARDENING, or HORTICULTURE, differs from agriculture in the comparatively small extent of ground used, the much greater variety of productions sought from it, and, consequently, also to no small extent in the manner of cultivation. The different ordinary productions of the garden are usually classed under the three heads of *flowers*, *fruits*, and *culinary vegetables*, concerning which see FLOWER-GARDEN, FRUITS, and KITCHEN-GARDEN. In large gardens, these departments are kept very distinct, particularly the first and last of them; but in small gardens they are generally more or less combined.

Where circumstances permit a choice of situation, a garden ought to be as fully as possible exposed to the rays of the sun, and in the northern parts of the world a gentle slope to the s., s.e., or s.w. is even preferable to a perfect level. But a slope in the opposite directions is by all means to be avoided. The form of a garden, unless where some peculiarity of situation determines it otherwise, is usually a parallelogram; and it is considered desirable, at least in the case of a walled garden, that it should be longer from e. to w. than from n. to s., in order to have as much as possible of the best exposure of wall for fruit-trees. This is also sometimes increased by the inclosure

within a fence of some other kind, of a piece of ground called a *slip*, exterior to the wall. A wall, either of brick or stone, is the best inclosure for a garden; brick being preferable on account of its more perfect adaptation to fruit-trees (see WALL-TREES); but where this is deemed too expensive, hedges of thorn, holly, etc., are resorted to. Hedges afford good shelter from winds, but have the disadvantages of harboring birds and snails to an inconvenient degree, and of withdrawing to their own support much of the strength of the adjacent soil. The garden, if in the form of a parallelogram, is usually divided into smaller parallelograms; a large garden, in the first instance, by cross-walls, smaller gardens at once by *walks*, and the *plots* thus formed are, if necessary, broken up by paths into smaller plots or *beds* for different kinds of plants. The paths within the plots are made by mere treading with the foot, when the ground has been newly dug, and are intended only for a single season; the walks are permanent, and are carefully made, usually by throwing out the earth to the depth of at least a few inches, and supplying its place with stones, cinders, broken bricks, slag from furnaces, or the like—whatever, in fact, is least likely to afford nutriment to plants—the surface being covered with gravel, which is kept clear of weeds by frequent stirring with the hoe or Dutch hoe. The walks are seldom less than 5 ft. in width. The ground occupied by them is still useful for the nourishment of plants, and particularly of trees or shrubs, growing near them. They have generally edgings (q.v.) to separate them neatly from the adjoining cultivated ground; and in damp situations, it is thought desirable to have them as much elevated in the center as is consistent with comfort in walking on them.

The soil of a garden is often prepared with a degree of care which is impossible in regard to a farm. A deep, rich, and easily penetrable soil is desirable; and where the immediate expense is not much regarded, the soil of a garden is sometimes almost entirely artificial; more generally, means are used for ameliorating the original soil. Of these means, one of the most important is *trenching*, by which the soil is deepened, and it is desirable that the soil of a garden should be at least 3 ft. deep. The proper depth of trenching, however, depends on the original depth of the soil and the nature of the subsoil; where the soil is pretty uniform to a considerable depth, the deepest trenching is advantageous; and the available soil may often be deepened by incorporating a portion of the subsoil with it; but if too much of a subsoil unsuited for vegetation is at once thrown up by trenching, it may communicate its own barrenness for years to the soil, ere it is mellowed by exposure to the air, manures, and the processes of cultivation. A stiff clay soil is very unsuitable for many of the crops required in a garden, and ought to be mixed with as much sand and vegetable matters as can easily be procured, both at the formation of the garden and afterwards. It is of course necessary, in all cases, that a garden be thoroughly drained; it is also of great consequence to have the means of irrigation, or at least of abundant watering, which, even where the climate is generally moist, greatly tends to increase the produce in dry seasons, and is almost always necessary to the perfection of certain crops. Indeed, if water can be obtained to form a small pond, or to pass through the garden as a rivulet, it may not only be turned to account for purposes of ornament, but also of utility, in the cultivation of many plants which cannot be successfully cultivated otherwise. This use of water is far from being so common as it might be in British gardens; even a cranberry-plot, although a pleasant thing and of easy attainment, being seldom thought of; the Chinese are better acquainted with it, and cultivate aquatic plants to an extent that has never been equaled amongst any other people.

A liberal supply of manure is necessary for a garden; the kinds of manure must be accommodated to the soil and to the different plants, and must often also depend in part on other circumstances. Care must be taken not to overdose with guano, or indeed with strong manure of any kind, by which plants might be killed rather than nourished. Farm-yard or stable-yard manure ought in general to be subjected to a process of decomposition in heaps before being used; and great advantage is derived from mixing it with other substances to form composts (q.v.). Nor ought any of the weeds and other refuse vegetable produce of the garden to be thrown away or dissipated in smoke, but all should be gathered into some corner appropriated to the purpose, there to decompose and form a heap of vegetable mold, which is for many purposes one of the best manures that can be used. Peat is, in some soils and for some plants, a very useful manure or ingredient in the formation of composts.

A garden ought to be *delved* or dug with the spade in the end of autumn, except where the presence of a crop prevents, the ground being left very rough, to expose the soil as much as possible to the influences of the weather. When the crops are planted in spring, a very slight stirring of the surface is all that is required. The usefulness of a garden, however, is much increased by making a considerable part of it produce crops even during winter. Greens of various kinds are commonly obtained from the garden during winter, even in the northern parts of Britain; the variety of winter crops in the southern parts is greater; but nowhere is a system of constant cropping so thoroughly maintained as in the market-gardens around London. Of course, constant cropping requires frequent and abundant manuring; and care is taken that each crop is succeeded by one of a completely different kind, a rule which is indeed always, as far as possible, to be observed both in horticulture and agriculture.

In laying out large gardens, fruit-trees trained on espaliers are not unfrequently planted around the borders of plots; in smaller gardens, gooseberry and currant bushes generally occupy this situation, often in addition to a plot entirely devoted to these bushes. Fruit-trees are often also planted as standards in the plots devoted to culinary vegetables. The productiveness of a garden may certainly thus be increased, as ground duly manured will yield a greater return of different kinds of produce than of one kind, whilst the owner has the additional pleasure of the greater variety; but it is to be remembered that the roots of trees and bushes spread a long way through the soil, and render it less suitable for many crops.

The implements most necessary in gardening are the spade, fork, rake, hoe, Dutch hoe, garden-line, wheelbarrow, pruning-knife, and watering-can.

The practice of gardening, of course, varies much in different countries, on account of the difference of climate, although some of its rules are of universal application. Of the history of gardening, little needs be said. We know little of the gardening of the most ancient nations, except that it was practiced, both for the sake of the produce and for pleasure, in all the seats of civilization; and that the Greeks borrowed their methods of gardening from the Persians, the Romans in their turn copying from the Greeks. Of the gardening of the Romans, some account has been transmitted to us, from which we know that they had attained no small proficiency in it. During the middle ages, gardening continued to be sedulously prosecuted in all the more civilized parts of Europe; Charlemagne enacted laws which contributed much to its promotion; and even in comparatively barbarous regions it was carried to great perfection by the monks, traces of whose skill and diligence are still to be seen in the vicinity of many a ruined monastery. The practice long prevailed of forming gardens, if situated on a slope, into terraces, and many a fine example of this kind of garden still remains at old country seats. In a few places, also, may be seen remaining specimens of the clipped hedges and fantastically clipped trees and bushes, which, until last century, seem to have been thought the chief ornaments of a garden; other puerile conceits being often associated with them, some of which are not yet entirely exploded, although a green bush in its natural form is universally regarded as more beautiful than one made to grow into the shape of a vase or of a peacock. But the history of taste in gardening accords with the history of taste in laying out parks and pleasure-grounds, concerning which, see LANDSCAPE-GARDENING.

The market-gardening of the neighborhood of London is on a scale proportionate to the greatness and wealth of the city; large fields, instead of little plots, are devoted to one kind of crop, and as an illustration it may be mentioned, that from one garden alone 200,000 gherkins (young cucumbers for pickling) have been sent to market in a single day. At Mitcham, near London, and at a few other places in England, medicinal plants are largely cultivated. *Nurseries* are gardens devoted to the raising of young plants, both trees and some kinds of culinary herbs, and of garden-seeds.

The cultivation of the more important garden-plants is noticed under their several heads. See also GRAFTING, GREENHOUSE, HOTHOUSE, HOTBED, STOVE, etc.

GARDES SUISSES, a celebrated corps in the French army, constituted "gardes" by royal decree in 1616. They comprised upwards of 2,000 men, were always unswerving in their fidelity to the Bourbon kings, and are chiefly remarkable for their heroic end. On Aug. 10, 1792, they withstood the Parisian revolutionary mob, and defended the palace of the Louvre till almost every man was cut down. During the resistance they offered, the royal family was enabled to escape to such shelter as the national assembly afforded.

GARDE-VISURE, the heraldic term used for what is commonly called the visor or front part of the helmet, used for the defense of the face and eyes.

GARDINER, a city of the United States, North America, is situated in the s.w. of the state of Maine, on the right bank of the Keneebec, 7 m. below Augusta. It has numerous saw, paper, and other mills; has a tannery, machine-shop, 2 foundries, a woolen factory, and a pottery. G. is at the head of the ship-navigation of the Kennebec, and 6,000 tons of shipping are owned here. Pop. '50, 6,486, but since the incorporation of parts of its territory with other townships, it has decreased to (1870) 4,479 (pop. of township).

GARDINER, Colonel JAMES, son of capt. Patrick Gardiner, was b. at Carriden, in Linlithgowshire, Jan. 11, 1688, and when only 14 years old, obtained a commission in a Scots regiment in the Dutch service. He afterwards entered the English army, and was severely wounded at the battle of Ramilies in 1706. G. fought with great distinction in all the other battles of Marlborough. In 1714–15, he was made capt.lieut. in a regiment of dragoons. Some time after, he gave a conspicuous proof of his courage, when, along with eleven other daring fellows (eight of whom were killed), he fired the barricades of the Highlanders at Preston. From an early period, G. was noted for his licentiousness, which was so marked, that ordinary officers, making no pretensions to religion, rather shunned his society, for fear of being corrupted; yet his constitution enabled him to pursue his vicious courses with apparent impunity, and in consequence of his continual gayety and good health, he was known as "the happy rake." But in the year 1719, he suddenly became the subject of profound religious impressions. The circumstances, as narrated by Dr. Doddridge (who had them from the hero himself),

contain much that is marvelous, supernatural, and exceedingly improbable. Doddridge himself is hardly satisfied with G.'s account, and hints at the possibility of the whole being a dream, instead of a "visible representation of the Lord Jesus Christ upon the cross, surrounded on all sides with a glory," etc. He also mentions that G. "did not seem very confident" whether the voice which came to him was really "an audible voice, or only a strong impression on his mind equally striking." Considerable doubt has recently been cast on the whole story by the publication of the *Autobiography of Dr. Alexander Carlyle*, edited by John Hill Burton (Edin. Blackwood & Sons, 1860), in which Carlyle denies altogether the truth of Doddridge's version of the story, at least of the supernatural portion of it. The attendant circumstances, however, are of little moment one way or another; the great fact is the conversion of the brave but wicked soldier into a pious and excellent Christian, and regarding this there has never been any doubt. In 1724, G. was raised to the rank of maj., and in 1726 he married lady Francis Erskine, daughter of the fourth earl of Buchan, by whom he had 13 children, only 5 of whom survived him. In 1730, he became lieut.col. of dragoons, and in 1743, col. of a new regiment of dragoons. He was killed at the battle of Prestonpans, Sept. 21, 1745; and the spot on which he fell is marked by a monument. The *Life of Colonel Gardiner*, written by Dr. Doddridge, is a favorite volume with the more religious portion of the public.

GARDINER, JOHN, 1731–93; b. Boston; son of Sylvester; studied law; was called to the bar in England, and practiced in London and in Wales; was one of the counsel for Wilkes in 1764; was in the Massachusetts legislature 1789–93; procured the abolition of the law of primogeniture in Massachusetts, the prohibition of special pleading, and the repeal of the theatrical laws. He was one of the leaders of the original Unitarian movement in Boston, 1787. He was drowned off cape Ann.

GARDINER, JOHN SYLVESTER JOHN, D.D., 1765–1830; b. Wales. He was educated by John Lovell of Boston, and for six years was a pupil of Dr. Parr in England; was ordained, 1787, by bishop Provost, and was in charge of the Prot. Episcopal parish of St. Helena, S. C., 1787–91; assistant minister and rector, after 1805, of Trinity church, Boston.

GARDINER, STEPHEN, a celebrated English prelate and statesman, the illegitimate son of Dr. Lionel Woodville, bishop of Salisbury, brother of Elizabeth Grey, queen of Edward IV., was b. at Bury St. Edmunds, Suffolk, in 1483. He studied at Trinity hall, Cambridge, and in 1520 became master of his hall. Soon after, through the patronage of the duke of Norfolk, he was introduced to cardinal Wolsey, who made him his secretary. In this capacity he acquired the confidence and favor of Henry VIII., and, from his knowledge of the civil and canon law, was sent to Rome in 1527, to conduct the negotiation with the pope for the king's divorce from Catharine of Aragon. He was then usually called Dr. Stephens. His exertions were unsuccessful; but having rendered services at the papal court to the bishop of Norwich, he was by him afterwards appointed archdeacon of Norfolk, while he promoted Wolsey's interests as a candidate for the pontificate. On his return, he was made secretary of state, and in the spring of 1531 was advanced to the archdeaconry of Leicester. In Nov. of the same year, he was installed bishop of Winchester. Notwithstanding his allegiance to the pope, he warmly supported the king's supremacy, and wrote a treatise in defense of it, entitled *De Vera Obedientia*. He was sent on embassies to France and Germany, and invariably opposed all measures attending to a religious reformation in England. He had a principal hand in the downfall and execution of Thomas Cromwell, in 1540, and he drew up an impeachment of heresy against Henry's last queen, Catharine Parr; but in a personal interview with Henry, she re-established herself in the king's favor, and G. fell into disgrace. At the accession of Edward VI., Jan. 28, 1547, for refusing to comply with the reformed doctrines, he was committed to the Fleet prison, but released in the following December. In 1548, he was again seized, and committed to the Tower, and on his refusal to sign certain articles submitted to him, was deprived of his bishopric. When Mary ascended the throne in 1553, he was set at liberty, restored to his see, and appointed lord chancellor and first minister of state. He took the lead in all the bitter persecutions of the Protestants during Mary's reign, and is charged with great caprice and extreme cruelty; but Dr. Maitland shows that many of the statements regarding G. are gross misrepresentations, and that in very many instances the parties brought before his court were arraigned for treason or sedition, rather than for heresy; and Roger Ascham freely confesses that G. interposed to protect him when summoned by the council on a charge of heterodoxy. The management of the queen's marriage with Philip of Spain was intrusted to him, and he officiated at their nuptials. He died Nov. 12, 1555. A treatise, entitled *Necessary Doctrine of a Christian Man*, printed in 1543, is said to have been the joint production of G. and Cranmer. G.'s character has been the subject of much criticism; but it can scarcely be doubted that he was a zealous, though not a spiritually minded, ecclesiastic. His devotion was that of an out-and-out *partisan;* but it was nevertheless real, after its fashion, for G. would have given his life to advance the cause which had commanded his sympathies and his support.

GARDINER, SYLVESTER, 1707–86; b. R. I.; studied medicine in Paris and London, and began practice in Boston. In 1760, he was the leader in founding the present city of Gardiner, Kennebec co., Me., the colony being composed almost entirely of Germans. He established a church and library there, and was one of the founders of King's chapel, the first Episcopal church in Boston. In the revolution he was a loyalist, and in the first year of the war went to England. He came back in 1785, and settled at Newport, where he died.

GARDINER'S ISLAND, a portion of Suffolk co., N. Y., at the entrance of Long Island sound; has an area of 3,300 acres, and has been the property of the Gardiner family ever since the white settlement of the country. It is used mainly for pasture, and the raising of cattle and sheep. It was on this island that the noted pirate (or privateer) capt. Kidd secreted much of his treasure, which was afterwards discovered and appropriated by the finders. There is a light-house on the n. part of the island.

GARDNER, JOHN LANE, 1793–1869; b. Boston; entered the army 1812, and was in service in Canada in the war with Great Britain, where he was wounded. In times of peace he filled various positions, and for service in the Florida war was made major, and had further promotion for gallant conduct in the Mexican war. He was col. at fort Moultrie in 1860, and secretly prepared to defend the fort against the anticipated attack, though he had less than 50 men. The secretary of war (Floyd, who went over to the confederacy) discovered his purpose, and ordered him to Texas, maj. Anderson taking his place in Charleston harbor. Four years before his death he was made brig.gen. for long and faithful service.

GARE FOWL. See AUK, *ante*.

GARES'SIO, a t. of n. Italy, in the province of Coni, and 17 m. s.e. of the town of Mondovi, stands on the left bank of the river Tanaro. Tradition assigns to G. an antiquity which seems confirmed by the numerous Latin inscriptions and remains found in its neighborhood; but owing to the many wars by which it has been devastated, its authentic archives have been entirely lost. Many varieties of marble are quarried here, especially the species known as persigliano. Pop. 6,500.

GARFIELD, JAMES ABRAM, b. in Cuyahoga co., Ohio, Nov. 19, 1831. Early left fatherless, his youth was spent in alternate periods of study at school and hard manual work for his own support. He worked on a farm, and is said to have driven horses on the Ohio canal. He learned the carpenter's trade, and worked at it during his school vacation in 1850. He had already entered the Geauga seminary at Chester, Ohio, where he began the study of Latin, Greek, and algebra. In 1851, he entered the Western Reserve Eclectic institute at Hiram, Ohio, where, in 1853–54, he was at once a student and teacher. In 1854, he entered Williams college, Mass., where he graduated with distinguished honor in 1856. He became classical teacher in the institute at Hiram, Ohio, of which he was elected the head one year later. Before entering college, he had united with the Disciples' church, in which he had been brought up, and, according to the usage of that denomination, though never formally ordained to the ministry, he often preached. In 1858, he entered his name as a student with a law firm in Cleveland, though his study was carried on by himself at Hiram. Graduating from college in 1856, at the time of the organization of the republican party, he cast his first vote that year for its candidate, and took part in the campaign in several speeches. In 1859, he was elected to represent the counties of Portage and Summit in the Ohio state senate. In this office he was an able debater and an industrious committee-man; and, as secession appeared in 1860–61, he contributed much to direct public sentiment and make ready for national defense. In Aug., 1861, he was appointed lieut.col. of volunteers, and in Sept., colonel. In Dec., he reported for duty to gen. Buell at Louisville, Ky., and was ordered, in command of a brigade of four regiments of infantry, to repel the rebels under gen. Humphrey Marshall from the valley of the Big Sandy river. He accomplished this task in Jan., 1862, defeating Marshall in the battle of Middle creek, and forcing him to retreat from the state. He was commissioned brig.gen., given command of the 20th brigade, and ordered to join gen. Buell. He reached, with his brigade, the field of Shiloh on the second day of the battle, and aided in the final repulse of the enemy; and next day, at the front with Sherman, took part in the attack on the enemy's rear-guard. He participated in the siege of Corinth, and, after its evacuation, was detailed to rebuild the railroad to Decatur. In Oct., 1862, he served on a court of inquiry, and in Nov. on the court-martial which tried gen. Fitz-John Porter. In Feb., 1863, he joined the army of the Cumberland under Rosecrans, just after the victorious but severe battle of Stone river, and was appointed chief of staff. In the discussion in regard to a forward movement, G., as chief of staff, collated the written opinions of the seventeen corps, division, and cavalry generals, and summarized their substance with cogent arguments of his own in a report which Mr. Whitelaw Reid pronounces "the ablest military document submitted by a chief of staff to his superior during the war." This report induced Rosecrans to move forward, contrary to the opinions of most of his generals, in the Tullahoma campaign, opening the way for the advance on Chattanooga. In the battle of Chickamauga, Sept. 19, G. issued the orders, as chief of staff, and, during the temporary reverse in the midst of the battle, rode

under fire across the country, and took word to Thomas, commanding the left wing, of the necessities of the situation, and, under Thomas, assisted in retrieving the disaster. G. was sent to Washington with dispatches, and was made maj.gen. for his services at the battle.

Having been elected a representative in congress, he resigned his commission, Dec. 3, 1863, and took his seat in the house of representatives, where he served as member of the military committee until the close of the war. Largely through his efforts and arguments, the commutation clause of the enrollment act was repealed, and the draft enforced at a time when otherwise the army would have been fatally depleted. Jan. 28, 1864, he delivered a speech on the seizure and confiscation of rebel property. In Mar., 1864, he spoke on free commerce between the states; and Jan. 13, 1865, on the constitutional amendment abolishing slavery. In 1865, he was assigned to the committee of ways and means, and Mar. 16, 1866, made an elaborate speech on the public debt and specie payments. In July following, he spoke on the revision of the tariff. In 1867–68, he took strong ground against the inflation of the currency. In Dec., 1867, he returned to the military committee as chairman, and held that place during the discussions on the reconstruction of the states lately in rebellion, delivering a speech, Jan. 17, 1868, on the power of congress in this relation, in which he severely criticised the action of the president, and the course of maj.gen. Hancock in his celebrated "order No. 40." He also sustained the motion to impeach the president.

In May, 1868, he made an argument on the currency, and July 15, on taxing U. S. bonds. In the next congress, he was chairman of the committee on banking and currency, and of a special committee to investigate the causes of the gold panic in Sept., 1869, which culminated in "black Friday." He also drafted a bill for the taking of the census of 1870, which was rejected by congess, but was made the basis of the law passed ten years later for the census of 1880. In 1871–75, he was made chairman of the committee on appropriations. In this office, he introduced many important reforms. He also discussed, April 4, 1871, the enforcement of the fourteenth amendment of the constitution, in which he condemned extreme theories both of centralization and local independence. In 1873, he was special commissioner in the removal of the Flathead Indians to the Jocko reservation. In 1873, charges of corruption were made against him in relation to the *Crédit Mobilier*. These excited earnest attention, especially in his own congressional district. He defended himself before his constituents in a pamphlet, as well as in personal speeches. After earnest discussion, he was renominated by a three-fourths vote of the convention, and re-elected by a large majority. The charges were renewed two years later, but were met with greater strength. In 1876, there was no opposition in the convention, and in 1878, he was re-elected by a large majority. In the 44th congress, 1875–77, the democratic party were in the majority. G. became a member of the committee of ways and means. He was a frequent and careful speaker on important measures, and was recognized as one of the leaders of the minority. After the presidential election of 1876, he was one of the prominent republicans requested to witness the counting of votes in Louisiana, and one of two republican members appointed by the house of representatives to sit on the electoral commission. In Dec., 1876, he was nominated by his party for speaker of the house of representatives, and received the same nomination on two subsequent occasions. In the 45th congress, 1877–79, he earnestly advocated the resumption of specie payments, delivering elaborate speeches in congress, and, as a recognized financial leader, a public address on the same subject in Chicago, Jan. 2, 1879. He spoke against the Bland silver bill, and in June, 1878, on the protective tariff, following up the discussion with speeches on the sugar tariff, and pulp and paper, and a careful minority report on hoop, band, and scroll iron. He also spoke, Feb. 19, 1878, on the pacification of the south and the prosecutions in Louisiana. In the extra session called to provide appropriations left unmade by the 45th congress, G. delivered, Mar. 29, a speech on "revolution in congress," in which he strongly assisted the passage of necessary appropriation bills without "political riders." In 1880, he was elected by the Ohio legislature U. S. senator for six years from Mar. 4, 1881.

In the republican national convention in Chicago, June, 1880, he was an earnest advocate of the nomination of John Sherman, of Ohio. The convention was divided between the advocates of gen. Grant, and an opposition favoring James G. Blaine, John Sherman, and others. G. was not at first considered a candidate, but after more than thirty ballots without a choice, and earnest discussions in which, and in the advocacy of his favorite candidate, he won the admiration of all sections, he received the nomination and carried a decided majority of presidential electors in November.

With the political ability displayed in his long and busy service in congress he combines a rare familiarity with history, a refined literary culture, and warm magnetic power in oratory; and has been said to present higher qualities of statesmanship and personal culture than any presidential candidate of either party since Henry Clay. His literary culture appears in historical and financial articles contributed to the *North American Review* and other periodicals.

GAR-FISH, *Belone*, a genus of fishes of the family *scomberesocidæ*, having the body greatly elongated and covered with minute scales. They are remarkable for the green

color of their bones. The flesh is wholesome, and is often used as food. One species only, the COMMON G. (*B. vulgaris*), occurs in the British seas. It is sometimes called greenbone, gorebill, and mackerel-guide, receiving the last name because it visits the coasts just before the mackerel, coming, in fact, from the deep to the more shallow water for the same reason, to deposit its spawn. It is usually about 2 ft. in length; the tail is forked; the pectoral and ventral fins are small; the upper part of the head and back is of a dark greenish-blue; the cheeks and gill covers, the sides and the belly, are silvery white, the dorsal fin and tail are greenish-brown, the other fins white. The G. is a very lively fish; it swims near the surface of the water, and not unfrequently springs out of it. It is brought to the London market in considerable quantities. The flesh has a flavor somewhat like that of mackerel. Some of the species of G., in other parts of the world, attain a much larger size. Other species are fresh-water fishes of warmer climates, as India and Guiana.

GAR'GANEY, *Anas querquedula* or *Querquedula circia*, a species of duck or teal, considerably larger than the common teal, although not so large as the wild duck, nor even as the widgeon; a rare British bird, more common in the s. of Europe, found also in the n. of Africa, and in Asia, at least as far to the e. as Calcutta. The male G. is a beautiful bird; the prevailing color dark-brown, finely varied on the cheeks and neck, with short hair-like lines of white; the speculum grayish-green, margined with white; a conspicuous white streak over each eye, extending to the neck. The female is smaller than the male, the colors more dull, and the white streak obscure. The G. is very much esteemed for the table.

GARGA'NO (anc. *Garganus*), a group of mountains in the province of Foggia, s. Italy, forming a peninsula, which stretches eastward for about 20 m. into the Adriatic sea. The group is composed of three chains of mountains, one of which turns to the n.e., the other to the s., and the third to the west. Its greatest length is 48 m., and its extreme breadth 24, the circumference being about 120 miles. The southern chain is bleak, sterile, and rocky, broken up into deep valleys, gorges, and ravines. The northern side, on the contrary, is entirely covered with woods, pastures, olives, pines, orange, and lemon trees; and the valleys on this side are lovely and fertile, especially those of Rodi, Ischitella, Vico, and Stignano. Owing to the great abundance of aromatic plants which grow among the rocks of the mountains, G. is still as famous for its honey as in the time of Horace, who sings its praise. Monte St. Angelo, one of the Gargano chain, is famous for the sanctuary dedicated to St. Michael in the year 492, in consequence of a legendary appearance of the saint to St. Lorenzo, archbishop of Sipontum. An annual festival of St. Michael is celebrated at this shrine, when crowds of pilgrims flock to the mountain, and increase greatly its picturesque effect by their gay and varied costumes. Mount G. possesses extensive alabaster quarries, which as yet have never been efficiently worked.

GARGANTUA, one of the satirical conceptions of Rabelais, variously interpreted by different authorities, some finding in it a political, and others a moral significance. Briefly, it epitomizes the career of Gargantua (son of Grangousier and Garganelle), who, soon as he was born, shouted for drink, so loudly that his voice reached the confines of his father's domains. The king exclaimed "*Que grand tuas!*" and the courtiers accepting the exclamation as conveying a name, it became corrupted into Gargantua. Every reader of Rabelais is familiar with the extraordinary adventure of the wonderful being, whose capacities in every respect were so enormous that in his infancy it required the milk of 17,913 cows to nourish him, and in his maturer days a salad for him was represented by lettuces so large that he swallowed with them six pilgrims who had taken refuge beneath them. Critics desirous of finding the meaning of this satire entirely political, assume that it referred to Francis I. and the intrigues of his court, whilst those who expect to trace in it a moral as well as political interpretation, conceive that it applies to the religious reforms and theological differences of the age.

GARGANTUAN, a term suggestive of boundlessness. Thus a gargantuan course of study, means one including all sources of knowledge, suggestive of the "bottomless pit of learning," which was the only thing likely to satisfy the prodigious mental capacity of Gargantua.

GAR'GARA, or GAR'GARUS. See IDA.

GARGET ROOT. See POKE.

GARGLE, or GARGARISM, a class of medicines intended to be churned about in the mouth and throat, with a view of cleansing the parts when affected with discharges from ulcers; or of acting as astringents (q.v.) or stimulants (q.v.), in relaxed sore throat. The best gargles are composed of vinegar or hydrochloric acid largely diluted; of chlorine water or Condy's disinfecting liquor, in putrescent cases; of port-wine, alum, and capsicum (cayenne pepper), when a stimulating effect is required; of tannin or oak-bark decoction with alum or borax, in case a pure astringent is needed. Gargles are very useful in the later stages of sore throat, in almost all its varieties.

GAR'GOYLE, a projecting spout, leading the water from the roof-gutters of buildings. Gargoyles of various forms have been used in almost all styles of architecture, but were peculiarly developed in connection with Gothic architecture. In some of the larger

mediæval buildings, where the height of the walls is considerable, the gargoyles have to project very far, in order to fulfill their duty of throwing the rain off the walls, and are in such cases of a large size. The gargoyles of French buildings have usually great prominence, much more than in England. Some gargoyles are small and plain, others large and ornamental, according to their various positions. They are carved into all conceivable forms—angelic, human, and of the lower orders; and as in fountains, the water is generally spouted through the mouth. In late castellated buildings, they frequently assume the form of small cannons projecting from the parapet. In modern times, the use of leaden pipes to convey away the water from roofs has almost entirely superseded the use of gargoyles.

GARHWAL, a district of British India, in the Kumáon division, under the jurisdiction of the lieutenant-governor of the North-western Provinces, situated between 29° 16' and 31° 5' n., and 78° 18' and 80° 8' e., and bounded on the n. by Chinese Thibet, on the e. by Kumáon district, on the s. by Bijnor district, and on the w. by Independent Garhwal or Tehri. Garhwal district consists almost entirely of rugged mountain ranges running in all directions, and separated by narrow valleys, which may almost be described as gorges or ravines. The only level portion of the district consists of a narrow strip of waterless forest, between the southern slopes of the hills and the fertile plains of Rohilkhand. The highest mountains are in the n. of the district, the principal peaks being Nanda Devi (25,661 ft), Kamet (25,413 ft.), Ircoul (23,382 ft.), Dunagiri (23,181 ft.), Badrinath (22,901 ft.), and Kedarnath (22,853 ft.). The Alaknanda, one of the main sources of the Ganges, receives with affluents the whole drainage of the district. The river is regarded as of peculiar sanctity, and is annually resorted to by thousands of devout Hindus. At Deoprayag the Alaknanda joins the Bhagirathi, and thenceforward the united streams bear the name of the Ganges. Navigation is impracticable in all the rivers, owing to the velocity of their currents, and the existence of shoals and rapids. Cultivation is principally confined to the immediate vicinity of the rivers, which are employed for purposes of irrigation; but out of a total estimated area of 5,500 sq.m. in 1872, only 209 were returned as under cultivation. Agriculture, however, is carried on with great skill and industry, by terracing out the hill-sides. Wheat, rice, and mandu are the staple crops, the surplus produce being exported to Thibet. Tea planting is also carried on under European supervision. Garhwal originally consisted of 52 petty chieftainships, each chief with his own independent fortress (garh). Between 400 and 500 years ago, one of these chiefs, Ajai Pal, ruler of Chanpur, reduced all the minor principalities under his own sway, and founded the Garhwal kingdom. He and his ancestors ruled over Garhwal and the adjacent state of Tehri, in an uninterrupted line till 1803, when the Gurkhas invaded Kumaon and Garhwal, driving Pridhiman Sah, the Garhwal chief, into the plains. For 12 years the Gurkhas ruled the country with a rod of iron, until a series of encroachments by them on British territory, led to the war with Nepal in 1814. At the termination of the campaign, Garhwal and Kumaon were converted into British districts, while the Tehri principality was restored to Pridhiman Sah, whose grandson still holds it. Since the annexation, Garhwal has rapidly advanced in material prosperity.

GARIBALDI, GIUSEPPE, was b. at Nice, July 22, 1807, of respectable parents. His father, the owner of a trading vessel, having been engaged all his life in maritime pursuits, young G. soon acquired a strong predilection for the hazards of a sea-faring life. With the permission of his father, he adopted the profession of a sailor, and made his first voyage to Odessa, under the command of an able and experienced seaman, capt. Pesante. He subsequently visited Rome, Cagliari, Vado, Genoa, etc., with various commanders, and soon became a skillful and fearless mariner, distinguished by his prompt decision in action and imperturbable presence of mind. In 1830, he was himself in command of the brig *Notre Dame de Grâce;* and about that time his sentiments of patriotism seem to have gained increased intensity, owing to his intercourse with a fervid Italian patriot, a casual passenger on board his vessel. From 1833, his acquaintance with Mazzini and the leaders of the Italian liberal movement dates, and from that period his unquenchable hatred of despotism, and devotion to the service of universal freedom, exercised a predominant influence on all his actions, and ultimately became the *single* motive of his career. In 1834, having compromised himself by participating in a futile revolutionary outbreak at Genoa, he was compelled to save his life by flight; and after extreme hardship, succeeded in gaining French territory simultaneously with the publication in Italy of the sentence of his condemnation to death. G. now resumed his seafaring life, and after some unimportant voyages, sailed for South America. When Rosas, the dictator of Buenos Ayres, declared war against the republic of Uruguay, G. offered his services to the latter, and soon gave proof of so remarkable a talent for military leadership, that he was raised to the supreme command both of naval and military operations. In 1848, war having broken out between Austria and the liberals of Italy, G. hastened to Europe. He bore an effective part in the whole of the Italian campaign, but especially distinguished himself at Rome by his resistance to the French forces, who during four weeks were successfully kept at bay, and repeatedly repulsed by the republican forces of Rome, under the direction of Garibaldi. Rome having at length succumbed to the immensely superior forces at the disposal of gen. Oudinot, G. marched

forth from the city as the French poured in. After a retreat of unparalleled difficulty through districts densely occupied by Austrian forces, G., accompanied by his devoted and heroic Brazilian wife, set sail in a small fishing-craft towards Venice; but being pursued by Austrian vessels, they were compelled to land at random, and not far from the shore, his wife, exhausted by the dangers and terrible exertions of their flight, expired in the arms of her husband. G. at length reached Genoa in safety, and from thence embarked for Tunis. He afterwards revisited South America, and acquired the command of an American trading-vessel. In that capacity, he touched at several English ports, where he was received with every testimony of public admiration and sympathy. During the interval which elapsed between the war of 1848 and that of 1859, G. publicly accepted the substitution of monarchy, such as it existed in Piedmont, for the republican form of government, for which he had originally combated, and was therefore free to serve as an irregular auxiliary of the Piedmontese forces on the commencement of hostilities. His services in that capacity were both brilliant and effective, notwithstanding the limited scope assigned for his operations. In the course of the following year (1860), the most triumphant and momentous enterprise of his marvelous career was accomplished. The chief result of the peace of Villafranca, by which the Italian war of 1859 was brought to an abrupt and unsatisfactory termination, was the immediate resumption by the Italian people of the revolutionary and progressive responsibilities which during the campaign had been vested by the nation in the government of Sardinia. Thus, early in 1860, insurrectionary disturbances broke out in Palermo, and although speedily quelled in the city by the great numerical strength of the Neapolitan garrison, they were constantly repeated throughout the interior of the island, where the insurgents were full of elation and daring, in consequence of G. having transmitted to them the assurance that he would speedily appear himself to head their struggle. In fulfillment of this promise, G. assembled at Genoa a volunteer force of 1070 patriots, and on May 5 set sail for the island of Sicily. On the 11th, his two small transport steamers having reached Marsala in safety, the landing of his followers was successfully effected in sight, and partially under fire, of the Neapolitan fleet. On the 15th, in the battle of Calatafimi, 3,600 Neapolitan troops were routed by G.'s small force, and to this opening victory may be largely attributed the subsequent success of the entire expedition. It at once cleared the way to Palermo, and inspired G.'s soldiers with irresistible confidence. On the 18th of the same month, G. and his little army of heroes occupied the heights which command Palermo, and after a desperate conflict with the royalist troops, fought his way into that unhappy city, which for several subsequent days had to sustain a ruthless bombardment from the united fire of the Neapolitan garrison and fleet.

The intervention of the British fleet, seconded by the isolated and destitute condition of the garrison shut up in the forts, induced the Neapolitan general to capitulate; and on his departure with his troops, G. remained in undisputed possession of the city and strongholds of Palermo. His first public enactment was the universal armament of the citizens. On the 20th of July, at the head of 2,500 men, he gave battle at Meiazzo to 7,000 Neapolitans, who were completely defeated, and compelled to evacuate the fortress. On the 25th, the Neapolitans were driven back into Messina, where G. made his triumphal entry on the 27th, the mutinous garrison, terrified at his approach, having compelled their general to submit. Towards the middle of Aug., G. made a descent in Calabria, and was immediately joined by large bodies of volunteers from all directions, by whom he was accompanied on his memorable and eventful march to Naples. On the 5th of Sept., G.'s army, which then amounted to 25,000 or 30,000 men, occupied Salerno on the withdrawal of the royalists, and on the 7th, amidst the frenzied enthusiasm of the inhabitants, G. entered Naples, with only one or two friends, to prove to Europe that his advent was that of a welcome liberator, and not of a terror-inspiring conqueror. On the previous day, the capital had sullenly witnessed the withdrawal of king Francis II. to the fortress of Gaeta. Before the close of the month, G. had enacted several judicious public reforms, calculated to increase the popularity of the Sardinian government, of which he was the declared representative, although for a brief space he accepted the title and powers of dictator. On the 1st of Oct., his military duties became again paramount, as the royalist troops, numbering 15,000 men, came forth from Capua, and attacked fiercely the whole line of the Garibaldians, spread along the Volturno. For some hours a terrible suspense reigned, and more than once it seemed as if success were about to desert the patriots at the last moment; but finally the royalists were driven back to Capua in disorder, and G. announced the result in his famous telegram —"Complete victory along the entire line." This was G.'s last triumph in that struggle. Victor Emmanuel, having reassumed the command of his army, crossed the papal frontier, routed the troops under Lamoricière, and passed on into the kingdom of Naples, where he was met by G., who immediately relinquished into his sovereign's hands the unconditional disposal of the southern volunteer army, and the absolute sway over the Neapolitan provinces.

In the spring of 1864, G. visited England, and was honored with a banquet by the lord mayor and the city of London. His sudden departure led to a good deal of public discussion, and the government of this country was compelled by public opinion to explain why it advised this course. During the campaign of 1866, he took the field, and

was engaged in operations against the Austrians in the Tyrol, where he sustained a severe repulse, which he retrieved next day, and was preparing to advance against the enemy, when the war was brought to a close, and he returned to Caprera. 1867 was a disastrous year for Garibaldi. He then openly organized an invasion of the states of the church, to complete the unification of Italy, but was made prisoner, and afterwards allowed to return to Caprera, in the neighborhood of which a man-of-war was stationed to prevent his escape. He did escape, however, only to be speedily defeated by the pontifical, reinforced by French troops. Again G. retired to his island home, which he left to fight for the French republic in 1870. He was nominated to the command of the irregular forces in the Vosges, and performed the best services in the field during the memorable Franco-Prussian war. In 1871, G. was returned a deputy to the French national assembly for Paris, but declined to sit, and returned to Caprera. He entered the Italian parliament in 1875. After much hesitation, he accepted from the parliament an annual pension of 50,000 lire. He devoted all his energy to the promotion of plans for the regulation of the course of the Tiber and the reclamation of the waste land near Rome. These schemes being pronounced impracticable, G. withdrew again from public life and settled at home. The novels G. has largely written (*Clelia*, 1870; *Cantoni il Volontario*, 1870; *I Mille*, 1874) have little literary value. Of G.'s two sons, the elder, MENOTTI, has fought with credit by his father's side.

GA'RIEP, otherwise ORANGE, is a river of South Africa, which, after a westward course of 1000 m., enters the Atlantic in lat. 28° 30′ s., and long. 16° 30′ east. It rises in the *Mont aux Sources* near lat. 29° s. and long. 30° e., at an elevation of about 10,000 ft. above the sea. Throughout nearly its whole length, it forms the northern boundary of the Cape Colony, separating it below the confluence of the Vaal from still independent tribes, and above that point from the Orange Free State. For the purposes of navigation, this river is almost useless.

GARIGLIA'NO (the *Liris* of the ancients) is the largest and most important river of southern Italy. Il rises in the Abruzzi, and discharges itself into the Mediterranean, in the gulf of Gaeta. The sluggish course of its muddy waters has been mentioned by more than one of the ancient poets. The name G. is said to be derived from an Arabic word, *garil*, which signifies marsh; it was adopted in the 11th c., after the expulsion of the Saracens, who had held possession of the neighboring plains. Amidst the marshy swamps near the river, Marius found concealment when pursued by Sulla. On the banks of the G. was fought a famous battle between the French, in 1503, and the Spaniards, commanded by Gonsalvo de Cordova, surnamed the great captain, in which the former were totally routed.

GARLAND. See CROWN.

GARLAND, a co. in w. Arkansas, on the Ouchita river, reached by a branch of the Cairo and Fulton railroad; formed since 1870. It is hilly, with fertile soil, producing cotton, corn, etc. It has mineral and medicinal springs, and pine forests. Co. seat, Hot Springs.

GARLAND, AUGUSTUS H., b. Tenn., 1832, and early settled in Arkansas as a lawyer. He opposed secession, but went with his state at last. He was elected to the provisional congress of the confederate states in 1861; was re-elected to the house of the same congress in 1862; was afterwards elected to the confederate senate, which office he held till the surrender in 1865. After the war he devoted himself to his profession, and in 1874 was elected governor under the new constitution of Arkansas.

GARLIC, *Allium sativum*, see ALLIUM, a bulbous-rooted plant, a native of the east, cultivated from the earliest ages. The stem rises to the height of about 2 ft., unbranched. and bearing at top an umbel of a few whitish flowers, mixed with many small bulbs, The upper part of the stem before flowering is rolled together into a ring. The leaves are grass-like, obscurely keeled, and not fistulous like those of the onion. Three alternate stamens are 3-pointed, the middle point bearing the anther. The bulb consists of about 12 to 15 ovate-oblong *cloves* or subordinate bulbs, which are axillary buds of its scales thus developed; it contains a viscid juice, which is sometimes used as a cement for porcelain, and has a penetrating and powerful *alliaceous* odor, which indeed pervades the whole plant, with a pungent aromatic taste. It is in general use as a condiment with other articles of food, and to many it is in this way very agreeable; to others, it is disgusting. It is much more largely used in many other countries than in Britain: in Spain, it enters into the composition of almost every dish. Garlic, or its fresh juice, is also used in medicine. It is stimulant, tonic, and promotes digestion; it has also diuretic and sudorific properties, and is a good expectorant, promoting all the excretions. Applied externally, it is a rubefacient, and is used to stimulate indolent tumors. A liniment of oil and garlic juice is sometimes applied to the chest in infantile convulsions. In some cases of deafness, much benefit is obtained from a clove of garlic or a few drops of the juice put into the ear. Garlic is also used as an anthelmintic. It owes its properties chiefly to *oil of garlic* (see following art.). Garlic abounds also in mucilage. The cultivation of garlic is extremely easy; it is generally propagated by its cloves.—Many of the species of *allium* are popularly called garlic, with some distinctive addition. *A. olera-*

ceum is sometimes called wild garlic in England, and its young and tender leaves are used as a pot-herb. Its leaves are semi-cylindrical, and grooved on the upper side. The stamens are all simple.

GARLIC, OIL OF. When cloves of garlic are distilled with water, about 0.2 per cent. of a brown heavy oil, with an acrid taste, and a strong disagreeable smell, passes over. By careful rectification from a salt water bath, about two thirds of the oil may be obtained in the form of a yellow liquid, which is lighter than water, and which, when treated with chloride of calcium (in order to dry it), and subsequently distilled from fragments of potassium, comes over pure and colorless as sulphide of allyl, an organic compound of very considerable interest, whose formula is C_6H_5,S. The crude oil also contains oxide of allyl (C_6H_5,O), and a compound of allyl still richer in sulphur than the sulphide.

Sulphide of allyl exists not only in oil of garlic, but also in the oils of onions, leeks, cress, alliaria, radishes, asafetida, etc. It is a light, clear, pale-yellow oil, with a penetrating odor of garlic; it boils at 284°, and dissolves readily in alcohol and ether.

Sulphide of allyl may be obtained from essential oil of black mustard (which in its purified form is represented by C_6H_5,C_2NS_2, and may consequently be regarded as sulphocyanide of allyl) by distillation with sulphide of potassium. The reaction is exhibited in the following equation:

$$\overbrace{C_6H_5,C_2NS_2}^{\text{Oil of Mustard.}} + \overbrace{KS}^{\text{Sulphide of Potassium.}} = \overbrace{C_6H_5,S}^{\text{Sulphide of Allyl.}} + \overbrace{K,C_2NS_2}^{\text{Sulphocyanide of Potassium.}}$$

We may perform the converse experiment, and obtain oil of mustard from oil of garlic by mixing alcoholic solutions of sulphide of allyl and corrosive sublimate, when a white precipitate is formed, represented by $C_6H_5S,2HgS + C_6H_5Cl,2HgCl$, and distilling this compound with sulphocyanide of potassium, in which case oil of mustard will be found among the products.

The pungency of horse-radish, scurvy-grass, and other allied plants, is due to the presence of this essential oil of mustard or sulphocyanide of allyl.

We shall postpone the further consideration of sulphocyanide of allyl to the article MUSTARD, OIL OF, but shall take this opportunity of very briefly noticing the chief members of the allyl series, which has recently been studied with very fruitful results by several of our most eminent chemists.

Free allyl (C_6H_5, or, more probably, C_6H_5,C_6H_5) is a very volatile combustible fluid, with a combined odor of ether and radishes. It is obtained by the action of sodium on iodide of allyl.

Allylic alcohol (C_6H_5O,HO) is metameric with acetone and propylic aldehyde, but it differs from them in its properties. It is obtained by the action of ammonia on oxalate of allyl.

Allyl ether or oxide of allyl (C_6H_5O) has been formd in at least two different ways, but the reactions accompanying its formation are too complicated for notice in this article. In exists ready formed in small quantity in oil of garlic, and some other oils that resemble it, and may be obtained by the decomposition of oil of black mustard.

The chloride, bromide, and iodide of allyl have all been obtained. The iodide is a colorless liquid, of specific gravity 1.789, with an ethereal and somewhat alliaceous odor. It is decomposed by digestion with a watery solution of ammonia, and on distillation with potash, a volatile base with a fishy ammoniacal odor is formed. It is probably *allylia*, or allyl-amine (C_6H_7N or C_6H_5,H_2N), the basic volatile alkali of the allylic series, which has also been obtained by a different process, and corresponds to ethylia or ethyl-amine in the ethylic series.—Miller's *Elements of Chemistry*, 2d edit., 1862, vol. 3, pp. 574–584; Gorup-Besanez, *Lehrbuch d. Chemie*, vol. 2, pp. 266–272; and the recent memoirs of Berthelot and Luca, Hofmann and Cahours, etc.

GARNET, a precious stone, some of the varieties of which are of great beauty; while some are less highly prized than other not more beautiful minerals, because much more common. Garnets are found most generally in mica-slate, hornblende slate, and gneiss; less frequently in granite and granular limestone; sometimes in serpentine and lava. There are numerous varieties, differing considerably in chemical composition; anhydrous silicates of alumina and lime or magnesia, colored with oxide of iron, of manganese, or of chrome. The color is various, generally some shade of red, brown, black, green, or yellow. Colorless and white specimens also occur. Red garnets sometimes contain so much iron as to be attracted by the magnet. The coarser variety of G., known as COMMON G., is generally found massive, often forming a very considerable part of the rock in which it occurs, so as even to be used as a flux in the smelting of iron. Crystallized garnets are also often very numerous in the rock which contains them; the crystals are sometimes very small, almost imperceptible grains; sometimes they are as large as a man's fist. The primary form of the crystal is a cube, but the common secondary forms are a rhombic dodecahedron, and an acute double eight-sided pyramid, the summits of which are abruptly acuminated by four planes.—NOBLE G., or PRECIOUS G., also called *almandine*, is generally of a crimson-red color, sometimes of so deep a tint, that jewelers hollow it out beneath, or place at the back of it a plate of silver. It is sometimes transparent, sometimes only translucent. It is found in some of the mountain-

-ous parts both of England and Scotland, but the finest garnets are imported from Syriam, in Pegu. A Syriam G., of a velvety black color, without defect, is valued at about half the price of a blue sapphire of the same weight. The large specimens of the precious G., are generally engraved with figures, and thus acquire a very high value.—A variety of G., known as *grossularia*, from its resemblance, in form, size, and color, to a green gooseberry, is brought from Siberia.—Cinnamon stone (q.v.) is a variety of garnet.—Pyrope, Vesuvian, and epidote are nearly allied to it.—Powdered garnets are often used for polishing and cutting other stones; this powder is known to lapidaries as *red emery*.

GARNIER, Jean Louis Charles, b. Paris, 1825; studied sculpture at the special school of design, and at the school of fine arts, having for instructors Levcil and Hippolyte Lebas. He traveled in Greece, where he made careful measurements of the temple of Jupiter in the island of Egina, and exhibited at the universal exposition in 1855, a polychromatic design for its restoration. In 1856, he wrote a paper explanatory of his design, which was published in the *Revue Archéologique*. A number of his paintings in watercolors were exhibited in the salons of 1857, 1859, and 1863. His plan for the new opera-house in Paris was unanimously chosen by count Walewski and the jury associated with him in 1861, over all competing plans; and G. was intrusted with the execution of this work. He was appointed inspector-general of civil constructions in Paris in 1877; was awarded the great prize in architecture in 1848, obtained a third-class medal at the salon of 1857, and a first-class medal in 1863, and was decorated with the cross of the legion of honor in 1864, and made an officer of the legion of honor on the opening of the new opera-house in 1875.

GARNIER, Marie Joseph François, 1839–73; usually called Francis Garnier; a French officer and explorer, perished by assassination in Tong-king. He entered the navy, and after voyaging in Brazilian waters and the Pacific, he obtained a post on the staff of admiral Charner, who from 1860 to 1862 was campaigning in Cochin-China. After some time spent in France, he returned to the East, and in 1852 he was appointed inspector of the natives in Cochin-China, and intrusted with the administration of the town of Cho-len or Sho-len. It was at Garnier's suggestion that the marquis de Chasseloup-Laubat determined to send a mission through Laos to Thibet, but as he was not considered old enough to be put in command, the chief authority was intrusted to capt. Doudart de Lagree. In the course of the expedition from Cratich in Cambodia to Shanghai, 5,392 m. were traversed; and of these, 3,625 m., chiefly of country unknown to European geography, were surveyed with care, and the positions fixed by astronomical observations, nearly all taken by Garnier himself. Volunteering to lead a detachment to Talifu, the capital of sultan Suleiman, the sovereign of Mohammedan rebels in Yunnan, he successfully carried out the perilous enterprise. When shortly afterwards Lagree died, Garnier naturally assumed command of the expedition, and he conducted it in safety to Yang-tse-Kiang, and thus to the Chinese coast. On his return to France he was received with enthusiasm. His experiences during the siege of Paris were published anonymously in the feuilleton of *Le Temps*, and appeared separately as *Le Siege de Paris: Journal d'un Officier de Marine*, 1871. Returning to Cochin-China, he found the political circumstances of the country unfavorable to further exploration, and accordingly he went to China, and in 1873 followed the upper course of the Yang-tse-Kiang to the waterfalls. He was next commissioned by admiral Dupré, governor of Cochin-China, to found a French protectorate or a new colony. On Nov. 20, 1873, he took Hanoi, the capital of Tong-king, and on Dec 7 he was slain.

GARNIER-PAGES, Louis Antoine, 1803–78; b. Marseilles; a French politician. He was chosen to the chamber of deputies in 1842, and once took high rank as a leader of the opposition and a promoter of reform agitation. In Feb., 1848, he was made a member of the provisional government, subsequently mayor of Paris, and in Mar., minister of finance. In May, he was one of the executive committee of five appointed by the assembly. In 1864, he was a member of the corps legislatif devoting himself especially to financial matters. At the fall of the empire, he was made a member of the government of national defense. He retired to private life in 1871. He published several works concerning the revolution in Paris.

GARNISH, Garnishment, Garnishee (Fr. *garnir*, to furnish). In English law, to garnish is to warn, and garnishment signifies a warning given to one for his appearance in court. But garnishment in its more usual sense is applied to the notice which a person sued in an action of detinue, and pleading the interest of a third party, is entitled to require to be served on that party. By the custom of London and certain other towns, a practice has existed from time immemorial, whereby a plaintiff suing in the local court was entitled to attach the property of the defendant in the hands of a third person, who was called the garnishee. See Foreign Attachment. But until the passing of the common law procedure act, 1854, there existed no means in England whereby a creditor could attach the property of his debtor in the hands of third persons in direct satisfaction of his claim. By that and a subsequent statute, it is now provided, that any one having obtained a judgment in one of the superior courts at Westminster, may require his debtor to be examined as to the debts due him, and unless a judge thinks it is vexatious, all debts owing to him by third

parties, called garnishees, may be attached in satisfaction of the plaintiff's claim. If the garnishee pay, he is forthwith discharged of the debt to his creditors, but if he fail to pay, and does not dispute the debt, the judge may order execution against him. It is to be observed that, under this statute, garnishment can still be obtained only where judgment has been obtained. Debts due to a defendant during the currency of an action, therefore, cannot be attached. In this respect, the remedy is less effectual than the custom of foreign attachment. In Scotland, debts due to a defender may be attached, both after judgment and on the dependence of an action. See ARRESTMENT.

GARNISHED, in heraldry. Any charge is said to be garnished with the ornament set on it.

GARONNE (anc. *Garumna*), the principal river in the s.w. of France, rises within the Spanish frontier in the Val d'Aran, at the base of mount Maladetta, in the Pyrenees. About 26 m. from its source, it enters the French territory in the department of the Haute Garonne, flows in a general n.e. course to Toulouse, then bends to the n.w., and continues to flow in that direction until, joined by the Dordogne, about 20 m. below Bordeaux, and widening afterwards into the estuary which bears the name of the Gironde, it enters the Atlantic at the pointe de Grave. The basin of the G. is upwards of 200 m. in length, and about an equal extent in width at its broadest part; although narrowing in the n.w. to a width of only 25 miles. The total length of the river is about 350 m.; and its natural navigation, which, however, is much impeded above Toulouse, commences at Cazères, 262 m. from its embouchure. At Bordeaux, the river attains a breadth of 1603 feet. Its principal affluents are the Tarn, Aveyron, Lot, and Dordogne, on the right; and on the left, the Save, Gers, and Baise. At Toulouse it is joined by the canal du Midi, which, running eastward to the Mediterranean, forms with the G. a means of communication between that sea and the Atlantic. The valley of the G. is noted for the beauty of its scenery, and its abundant produce of corn and wine.

The estuary of the Gironde is 40 m. in length, and about 4 m. in average breadth. Below Blaye, its shores consist of bare rocks and bleak and dreary heath.

GARONNE, HAUTE, a department in the s. of France, is bounded on the s. by the Pyrenees, and on the w. by the departments of Hautes Pyrénées and Gers. It has an area of 2,420 sq.m., and a pop. (1876) of 477,730. It is watered throughout by the Garonne, from which it derives its name, and within the basin of which it wholly lies. Occupied in the s. by a branch of the Pyrenean range, the slope of the department, and the course of its streams, are toward the n. and n.e., where the land is generally level. The soil is on the whole good; that in the valleys is remarkably productive, and brings forth heavy crops of grain, maize, flax, and potatoes. Orchard-fruits, with melons and tobacco, are produced in abundance, and the annual yield of wine is about 14,300,000 gallons, two thirds of which is exported. Minerals also abound, but, with the exception of iron, have not yet been obtained in any great quantity. The chief manufactures are woolen and cotton fabrics and hardware; and these, with timber, cattle, wine, and preserved meats, are the principal exports. The department of Haute G. was formerly divided between the provinces of Languedoc and Gascony. It is divided into the four arrondissements of Toulouse, Muret, St. Gaudens, and Villefranche, with Toulouse as capital.

GARRARD, a co. in e. central Kentucky, on the Kentucky river, intersected by a branch of the Louisville and Great Southern railroad; 250 sq.m.; pop. '70, 10,376—3,404 colored. Surface undulating, and soil fertile, producing corn, wheat, etc. Co. seat, Lancaster.

GARRARD, JAMES, 1749–1822; b. Va.; served in the revolutionary war, and in the Virginia legislature. He eventually settled in Kentucky, and in 1796 was made governor of that state, a position which he continued to occupy until 1804.

GARRARD, KENNER, b. Ky., 1828; an American officer, graduated at West Point, and passed through the various grades, until, in 1863, he was appointed col. of New York volunteers. He took part in the battles of Fredericksburg, Chancellorsville, and Gettysburg, and served in the army of the Potomac as brig.gen. of volunteers. From this date until his resignation in 1866, he was continually in active service, distinguishing himself more particularly as leader of the party which, in the campaign against Mobile, undertook the storming of Blakely.

GARRETT, a co. in n.w. Maryland bordering on Pennsylvania and West Virginia, bounded by the Potomac, and intersected by the Baltimore and Ohio railroad; 670 sq.m.; pop. '72, 10,857. It has a mountainous surface, with much forest-land, with abundance of coal and iron. Co. seat, Oakland.

GARRETT, ELIZABETH, b. London, 1837; studied medicine in Middlesex hospital, and in Edinburgh, and received a diploma of M.D., in 1870, from the university of Paris. She has had a large and lucrative practice in London. At the close of 1870, she was elected one of the London (metropolitan) school-board by 20,000 more votes than were cast for any other candidate. In 1871, she married a Mr. Anderson.

GARRETT, THOMAS, b. Darby, Pa., 1783; d. Wilmington, Del., 1871; an abolitionist. He learned the trade of a cutler and scythe-maker, and in 1820 removed to Wilmington, Del., and entered into business as an iron and hardware merchant. In his new home he

avowed his anti-slavery opinions without the least reserve, and it was not long before the slaves and colored people generally learned that he was their friend. Though he never enticed slaves to run away, he was always ready to aid them in their flight when they appealed to him for protection from their pursuers. This in a slave state exposed him to great danger; but he was as shrewd as he was bold, and rarely found himself in the clutches of the law. His name was familiar to the slaves of Delaware, Maryland, and Virginia; and during a period of 40 years there was a constant procession of fugitives seeking his protection and aid. Not less than 3,000 of this class were indebted to him for their successful escape. It was rare indeed that one, after passing through his hands, was recaptured. He was compelled to resort to many ingenious devices in this work, but he made no secret of the fact that he was engaged in it; and such was his reputation for success, that few slaveholders thought it worth while to pursue their runaways any further after learning that they had fallen into his hands. Twice he was convicted in the district court of the United States of violating the provisions of the fugitive-slave law, and fined in such sums as to deprive him of nearly all his property. On the last of these occasions, the judge, in pronouncing sentence, expressed the hope that the penalty imposed would teach him a useful lesson. The Quaker thereupon declared in open court, that, no matter what might be the consequences to himself, he should never close his door against the fugitive slave. "If," said he, "there is one now present, let him know that he has a friend in Thomas Garrett." His business would have been utterly broken up at this time, if his fellow-citizens of Wilmington had not volunteered to furnish him all the capital he needed. Such was his reputation for integrity and business ability, that even the banks of Wilmington lent him their aid without any security but his own name. Just before he died, the colored people of Wilmington besought him that they might have the privilege of bearing his body to the grave, and to this request he gave his assent. When he died, the whole city rose up in honor of his memory.

GARRETTSON, Freeborn, 1752–1827; b. Md. He became a Methodist minister in 1775, traveled in several of the states, and in 1784 was a missionary in Nova Scotia. His late years were passed in New York state. He was one of the earliest to pronounce strongly against slavery, and liberate many slaves out of his own means. In his will he provided for the continuous support of one missionary.

GARRICK, David, actor and author, was b. at Hereford in 1716, and educated at the grammar school of Lichfield. After a short residence at Lisbon with an uncle, who was a wine-merchant in that city, he returned to England, and in 1735 became a pupil of the famous Dr. Johnson; but in the course of six months, master and pupil both proceeded to London, with the view of improving their fortunes. G. attempted the study of law, but an irresistible instinct soon urged him to the stage. He made his *début* at Ipswich in 1741, as "Aboan," in the play of *Oroonoka*, and obtained a great success. Encouraged by this, he ventured to appear before a London audience in the autumn of the same year, and in the character of "Richard III." was received with prodigious applause. The fashionable theaters were emptied to gaze upon the new star that was shedding an unwonted luster on the obscurity of the Goodman's Fields' stage, and the other theatrical celebrities, such as Quin and Cibber, could not conceal their chagrin and disgust. In the following year, G. accepted an engagement at Dublin, where he excited the Hibernian enthusiasm to a miraculous degree. The playhouse, we are told, was so crowded, "that a very mortal fever was produced, which was called Garrick's fever." In 1747, he became joint-patentee of Drury Lane, and two years after, married Mdlle. Violette, a foreign *danseuse;* a circumstance which, somehow or other, he feared might expose him to ridicule, and to prevent such a thing, he got his friend Mr. Edward Moore "to write a diverting poem upon his marriage." This was not the only occasion when his sensitiveness to malicious banter induced him to forestall the wits and critics, and so blunt the edge of their jests and criticisms. Before acting "Macbeth" for the first time, he wrote a humorous pamphlet, reflecting on the "mimical behavior of a certain fashionable faulty actor," to wit, Garrick himself. In 1763, he paid a visit to Italy, and in 1769 projected and conducted the memorable jubilee at Stratford-upon-Avon in honor of Shakespeare. He died in London, Jan. 20, 1779, having accumulated a fortune of £140,000. G ranks as one of the very greatest—perhaps *the* very greatest—of English actors. He exhibited a Shakespearian universality in the representation of character, and was equally at home in the highest flights of tragedy and the lowest depths of farce. But the *naturalness* which so wonderfully marked him on the stage, often forsook him in real life. He was jealous to an extreme, and had an unbounded stomach for flattery. His friend Goldsmith hits off his character happily in the poem, entitled *Retaliation*. As a dramatic author, G. does not hold a high place. He wrote about 40 pieces, some original, but mostly adaptations of old plays. His numerous prologues and epilogues, however, deserve considerable praise.

GARRISON (Fr. *garnison*, from low Latin *garnisio*, military furniture), the troops occupying a town or fortress, either for defensive purposes, or merely as ordinary quarters.

GARRISON, William Lloyd, an eminent American abolitionist, was b. at Newburyport, Mass., Dec. 10, 1805. His father was a man of literary taste and ability, but fall-

ing into dissolute habits, deserted his wife, who, for the support of her family, had to act as professional nurse. As early as 1814, William was apprenticed to a shoemaker at Lynn, but his mother, finding that the business did not suit him, sent him back to Newburyport, where he went to school for some time, working out of school hours in order to pay his board. In 1818, he commenced to learn cabinet-making, but this proving also distasteful to him, he was, in Oct. of the same year, apprenticed to the printer of the *Newburyport Herald*. This occupation suited his taste; he soon made himself master of the mechanical part of the business, and when only 16 or 17 began to write for the *Herald*. His contributions, which were anonymous, were favorably received, and he soon commenced to send articles to the *Salem Gazette* and other papers, drawing the attention of political circles by a series of articles under the signature Aristides, with the view of removing the almost universal apathy on the subject of slavery. In 1824, he became editor of the *Herald;* and in 1826, proprietor and editor of the *Free Press*, in which he was accustomed to set up his own editorial articles in type, without writing them out. This enterprise was unsuccessful, and he went to Boston, where he worked for a time as a journeyman. In 1827, he became the editor of the *National Philanthropist* in that city; in 1828, he joined a friend in the publication of the *Journal of the Times* at Bennington, and in 1829 he joined Mr. Lundy at Baltimore, in editing the *Genius of Universal Emancipation*. The vigorous expression of his anti-slavery views in this last paper led to his imprisonment for libel, from which he was released by Mr. Tappan, a New York merchant, who paid his fine. He now prepared a series of emancipation lectures, subsequently delivered in New York and other places. He returned to Boston, and in 1831 started the *Liberator*, a paper with which his name is inseparably associated, and which he carried on for 35 years, until slavery was abolished in the United States. For the first few years almost every mail brought letters to G., threatening his assassination if he did not discontinue his journal; the legislature of Georgia offered a reward of $5,000 to any one who should prosecute and bring him to conviction in accordance with the laws of that state; in 1835, he was severely handled by a Boston mob, and the mayor of that city was constantly appealed to from the South to suppress his paper. In spite of all, he successfully persevered. In 1833, he visited Great Britain, and on his return organized the American anti-slavery society, of which he was afterwards president. He visited England again, in the furtherance of his anti-slavery opinions, in 1846 and 1848. In 1865, after the total abolition of slavery in the United States, his friends presented him with $30,000 (£6,000) as a memorial of his services. In 1867, he was once more in England, and entertained at a public breakfast in St. James's hall, where the duke of Argyll and Mr. Bright complimented him on his public services. Some *Sonnets and other Poems* by him were published in 1847, and *Selections from his Writings and Speeches* in 1852.

GARROT, *Clangula*, a genus of the oceanic section of ducks (q.v.), having the bill shorter than the head. One species, the GOLDEN-EYE (*C. vulgaris* or *C. chrysophthalmus*), a bird not quite so large as a widgeon, is a common winter visitant in Britain, appearing in small flocks, most frequently in severe weather, not only in estuaries, but on the lakes and rivers of inland parts of the country, as it does on those of all the central and southern parts of Europe, and equally on those of the temperate parts of Asia and North America. It breeds in arctic and sub-arctic regions, preferring wooded districts, and forms its nest either on the ground, in the crevice of a rock, or the hole of a tree. The parent birds are said to transport their young from the nest to the water, holding them under the bill, and supported by the neck. The Lapps take advantage of the predilection of the golden-eyes for making their nests in holes, by setting up boxes for them, and then robbing them of their eggs.—Another British species is the HARLEQUIN G., or HARLEQUIN DUCK (*C. histrionica*), but it is only a rare winter visitant. Like the golden-eye, it is a native of the northern parts of the world generally. The male is curiously streaked and marked with white. The BUFFEL-HEADED G., or BUFFEL-HEADED DUCK (*C. albeola*), is of extremely rare occurrence in Britain, but is very common in North America, where it is often called the spirit duck, a name which is said to have been bestowed in allusion to its power of eluding observation by diving. It is rather smaller than the golden-eye and harlequin garrot. The flesh of the garrots is eaten, but not very highly esteemed.

GARROTTE' (Spanish *garrote*, a stick or cudgel), a mode of execution practiced in Spain and the Spanish colonies. Originally, it consisted in simply placing a cord round the neck of a criminal, who was seated on a chair fixed to a post, and then twisting the cord by means of a *stick* (whence the name) inserted between it and the back of the neck, till strangulation was produced. Afterwards, a brass collar was used, containing a screw, which the executioner turned till its point entered the spinal marrow where it unites with the brain, causing instantaneous death. The inquisitors were wont to grant as a favor this mode of strangulation, before being burned, to such condemned persons as recanted. If the executioner was unskillful, however, the pain was sometimes very great. Llorente (*Hist. de l'Inq.*, t. iii. p. 472) mentions that at an *auto da fé* (q.v.) at Cuença, a poor Jew, who had obtained this dismal privilege of preliminary strangulation, noticing the bungling manner in which the executioner had performed the operation on the two who preceded him, said to the latter: "Peter, if you are likely to

strangle me so clumsily, I would much rather be burned alive." The same process was also applied as a species of torture to the limbs, or to such portions of the body as might be injured with comparative impunity. It is probable that the Spaniards adopted the G. from the Moors; at all events, in its primitive form, it exactly resembles the punishment of the bowstring in use among Mohammedan nations.—Garrotting is also the name given in England and Scotland to a species of robbery which for some time was rather common, in which the robbers suddenly come behind their victim, and throwing a cord, or handkerchief, or something of the sort, round his neck, produce temporary strangulation till their purpose is effected.

GARROVILLAS-DE-ALCONETAR, a small t. of Spain in the province of Caceres is situated 20 m. n.w. of the town of that name, on the left bank of the Tagus. It has manufactures of linen and woolen fabrics, and some trade in grain, cattle, and fruit. Pop. 6,573.

GARROW, or GARO, HILLS, a district in India on the Brahmaputra river, 3,390 sq. m.; pop. about 50,000. It is well watered and wooded, and very fertile, the chief product being cotton. One of the curiosities of the region is the enormous amount of rain, said to amount to from 500 to 600 in. in a year. There are American missions and eight missionary schools in the district.

GARTER. See BEND.

GARTER, ORDER OF THE. The order of the garter was instituted by king Edward III., and though not the most ancient, is one of the most famous of the military orders of Europe. Selden says that it "exceeds in majesty, honor, and fame all chivalrous orders in the world." It is said to have been devised for the purpose of attracting to the king's party such soldiers of fortune as might be likely to aid in asserting the claim which he was then making to the crown of France, and intended as an imitation of king Arthur's round table. The round table was erected at Windsor, and the knights and nobles who were invited from all parts of the world were exercised at tilts and tournaments as a preparation for the magnificent feasts that were spread before them. That general "jousts and tournaments" of this description were held at Windsor, is known from the letters summoning them bearing date Jan. 1, 1344, and quoted by sir Harris Nicolas in his *Orders of Knighthood*, i. p. 6; and from the narrative of Froissart, who connects them with the institution of the order. The original number of the knights of the garter was twenty-five, his majesty himself making the twenty-sixth. The story that the countess of Salisbury let fall her garter when dancing with the king, and that the king picked it up and tied it round his own leg; but that, observing the jealous glances of the queen, he restored it to its fair owner with the exclamation: *Honi soit qui mal y pense*, is about as well authenticated as most tales of the kind, and has, moreover, in its favor that it accounts for the otherwise unaccountable emblem and motto of the order. Sir Harris Nicolas, whose error does not usually lie in the direction of credulity, says, that though the writers on the order have treated it with contempt, they have neither succeeded in showing its absurdity, nor suggested a more probable theory. Various dates are assigned to the order of the garter. Froissart, as above mentioned, gives 1344, and fixes on St. George's day (April 23), 1344; but Stow, and, it is said, the statutes of the order, fix it six years later—viz., 1350. The original statutes have long since perished, and little reliance can be placed on the modern copies of them, and nothing is known on the subject with precision till the compilation of the *Black Book* in the latter part of the reign of Henry VIII. In these circumstances, sir Harris Nicolas is of opinion, that, though founded at the former period, it was not till the latter that the order was finally organized, and the companions chosen. It was founded in honor of the holy Trinity, the virgin Mary, St. Edward the confessor, and St. George; but the last, who had become the tutelary saint of England, was considered its special patron; and for this reason it has always borne the title of "The Order of St. George," as well as of "The Garter." A list of the original knights, or knights-founders, is given by sir Harris Nicolas.

The well-known emblem of the order is a dark-blue ribbon edged with gold, bearing the motto *Honi soit qui mal y pense*, in gold letters, with a buckle and pendent of gold richly chased. It is worn on the left leg below the knee. The mantle is of blue velvet, lined with white taffeta, and on the left breast a star is embroidered. The hood and surcoat are of crimson velvet, lined with white taffeta. The hat is of black velvet, with a plume of white ostrich feathers, in the center of which there is a tuft of black herons' feathers, all fastened to the hat by a band of diamonds. The collar is of gold, and consists of 26 pieces, each in the form of a garter. The "George" is the figure of St. George on horseback encountering the Dragon, and is worn hanging from the collar; there is a "lesser George" pendent to a broad dark-blue ribbon over the left shoulder. The star, which is of eight points, is silver, and has upon the center the cross of St. George, gules, encircled with the garter. The officers of the order are—the prelate (the bishop of Winchester), the chancellor (the bishop of Oxford), the registrar (the dean of Windsor), the garter king of arms (q.v.), and the usher of the black rod.

GARTER KING OF ARMS is also the principal king of arms in England. Though held by the same person they are distinct offices. The first was instituted for the service of

the order of the garter (see GARTER), not on its first foundation, but afterwards by Henry V. as sovereign, with the advice and consent of the knights-companions. The peculiar duty of garter king of arms is to attend upon the knights at their solemnities, to intimate their election to those who are chosen by the order, to call them to be installed at Windsor, to cause their arms to be hung up over their stalls, and to marshal their funeral processions, and those of royal personages, and of members of the higher nobility. In the capacity of principal king of arms, he grants and confirms arms, under the authority of the earl marshal, to whom he is not subject as garter king of arms. All new grants or patents of arms in England are first signed and sealed by garter king of arms, and then by the king of the province to which the applicant belongs. See HERALDS' COLLEGE.

GARTH, SAMUEL, an eminent physician, and a poet of considerable reputation, was b. at Bolam, in the c. of Durham, in 1660. He was a member of Peterhouse, Cambridge, and graduated as M.D. in 1691. In the following year he settled in London, and was admitted into the college of physicians, in which institution he subsequently held several important offices. His professional skill was associated with great conversational powers, and he soon acquired a very extensive practice. The year 1700 presents an incident in G.'s life which did him everlasting honor. He it was who stepped forward to provide a suitable interment in Westminster abbey for the neglected corpse of Dryden, which he caused to be brought to the college in Warwick lane; and he pronounced a eulogium over the great poet's remains. On the accession of George I., he received the honor of knighthood, was appointed physician in ordinary to the king, and physician-general to the army. He died in London, Jan. 18, 1718.

G. is best known in our literary history as the author of *The Dispensary*, a poetical satire on the apothecaries and those physicians who sided with them in opposing the project of giving medicine gratuitously to the sick poor. The sketches of some of his contemporaries—as, for instance, Drs. Gould, Tyson, and How, who are introduced into the poem as "obsequious Umbra," "slow Carus," and "shrill Querpo"—are severe; and although, doubtless, exaggerated by poetic license, must have been true to nature, or the work could not have obtained such an immediate and extensive circulation. The first edition came out in 1699, and the second and third followed in the course of a very few months. In 1706, he brought out the sixth edition with considerable additions. In 1715, he published a poem entitled *Claremont*, and in 1717 he superintended and contributed to a translation of Ovid's *Metamorphosis* by some of the most eminent writers of that age—Addison, Pope, Gay, Congreve, and Rowe being amongst the contributors.

Pope frequently refers to him, both in his letters and in his poems, with great respect:

"And we, too, boast our Garth and Addison."

The second *Pastoral* was dedicated to G.; and in a letter to Jervis in 1718, Pope states that he entertains "the truest concern for his loss."

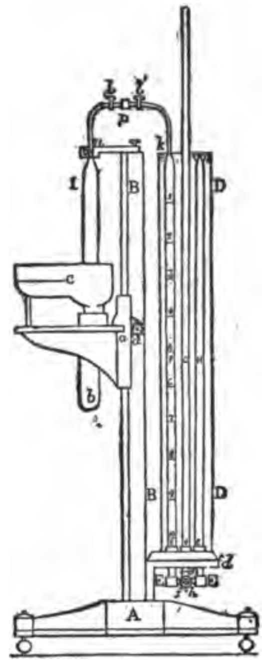
GARTNER, FREIDRICH VON, a distinguished German architect, was b. at Coblentz in 1792. His father, also an architect, removed in 1804 to Munich, where young G. received his first education in architecture. To complete that education, he traveled in 1812 to Paris, and in 1814 to Italy, where he spent four years in the earnest study of antiquities. The fruits of this labor appeared in 1819 in some views, accompanied by descriptions, of the principal monuments which have been preserved in Sicily (*Ansichten der am Meisten erhaltenen monumente Siciliens, Lithographien mit erläuterdem Text*). After a visit to England, he was called, in 1820, to the chair of architecture in the academy of Munich. With this appointment began his work as a practical architect. Many of the architectural ornaments of Munich, and various other buildings throughout Germany, as well as the new royal palace at Athens, are built after his plans. In the style of his works, which have all a common impress, G. represents the renaissance of the mediæval architecture in its Romanesque forms. The round arch with its accompaniments prevails in them all. G. was rewarded with the fellowship of several academies, with orders of his own and foreign countries, with a degree from Erlangen, with the office of head government-surveyor of buildings, and with the directorship of the academy of arts in Munich. He died in the midst of his labors, April 21, 1847.

GARTSHER'RIE, a village of Lanarkshire, in the parish of Old Monkland, is noted for its extensive iron-works. In the immediate neighborhood are the iron-works of Dundyvan, Clyde, and Calder, all of which, together with Coatbridge, contribute to the iron-trade of Glasgow. See article LANARKSHIRE.

GAS, ANALYSIS OF. This department of analysis originated in the attempts of various chemists, during the last quarter of the 18th, and the first quarter of the present century, to determine the volume of oxygen in specimens of atmospheric air taken from different localities. The general principle on which the early eudiometers (q.v.) were constructed, was that of exposing atmospheric air to the action of some substance which combined with its oxygen. Various eudiometers and eudiometrical processes were devised by Priestly, De Marté, Guyton, Seguin, Volta, Berthollet, Hope, Henry, Pepys, Ure, etc., which are now only of interest in an historical point of view. They were not only almost exclusively limited to the determination of the quantity of oxygen, but they were more or less imperfect in their action; and the analysis of the gases generally did

not become developed into a system until prof. Bunsen of Heidelberg, some 30 years ago, began to devote himself to the subject. Ingenious instruments for the analysis of gaseous mixtures have recently been devised, not only by Bunsen, but by Regnault and Reiset, Williamson and Russell, and Frankland and Ward. The instrument devised by the last-named gentlemen we shall presently describe; but before doing so, we must say a few words on the collection of gases for analysis. In collecting gases, we usually employ small glass vessels, the contents of which, consisting of water, mercury, or air, are displaced by the gas to be analyzed. Of these three fluids, water is the least capable of general application, inasmuch as it gives rise to phenomena of absorption and diffusion, which modify the composition of the gas that is to be collected, and gases are more or less soluble in it. For the best methods of collecting gases from mineral springs and waters, from volcanic lakes, geysers or boiling springs, from openings in rocks, clefts of glaciers, furnaces, fissures in volcanic craters, etc., we must refer to Bunsen's *Gasometry*, translated by Roscoe, 1857. Again, it must be recollected that the nature of the gas that is evolved often varies with the progressive phases of a decomposition, as, for example, in the process of coking, or in the phenomena of combustion and decomposition occurring in the strata of a furnace. In these cases, it is necessary to collect a series of specimens during the progress of the decomposition.

Our limited space will not allow of our entering into the various details of the complicated apparatus employed by Frankland and Ward, which is regarded as the best that has yet been invented. A full account of it may be found in their memoir in the *Quarterly Journal of the Chemical Society*, or in Williams's *Handbook of Chemical Manipulation*. The following remarks, which we take with slight modifications from their memoir, will, we trust, sufficiently explain the manner of using this apparatus. We take as an example an analysis of atmospheric air. A few (three or four) cubic inches of air, freed from carbonic acid, having been introduced into the tube I, it is transferred into F for measurement by opening the cocks *l*, *l'*, and placing the tube F in connection with the exit-pipe *h*; the transference can be assisted, if necessary, by elevating the mercurial trough C. (The part marked *b* in the figure is merely the tubular well of the mercurial trough C.) When the air, followed by a few drops of mercury, has passed completely into F, the cock *l* is shut, and *f* turned, so as to connect F and H with *h*. Mercury is allowed to flow out until a vacuum of 2 or 3 in. in length is formed in H, and the metal in F is just below one of the graduated divisions; the cock *f* is then reversed, and mercury very gradually admitted from G, until the highest point in F exactly corresponds with one of the divisions upon that tube: we will assume it to be the sixth division, there being ten divisions in all. This adjustment of mercury, and the subsequent readings, can be very accurately made by means of a small horizontal telescope, placed at a distance of about 6 ft., and sliding on a vertical rod. The height of the mercury in H must now be accurately determined; and if from the number thus read off, the height of the sixth division above the zero of the scale in H is deducted (the scale on H is not marked in the figure), the remainder will express the true volume of the gas, no corrections being required for variations of temperature, atmospheric pressure, tension of aqueous vapor, etc.



A, a tripod, with leveling screws; BB, a vertical pillar, to which is attached, C, a mercurial trough, movable by a rack and pinion, *aa*; DD, a glass cylinder, 36 in. long, with an internal diameter of 4 in., containing three tubes, F, G, H, which communicate with one another and with the exit-pipe, *h*, by the apparatus E *f* E. The rest of the figure will be sufficiently intelligible from the description given in the text.

Hydrogen, in the proportion of half the volume of the air used, must now be passed into I, and from thence into F, when the volume of the mixed gases must be again determined, as before. An electric spark must now be passed through the mixed gases in F by means of the platinum wires at *m*. A slight explosion occurs, after which we observe a considerable contraction in the volume of the mixed gases. The determination of this contraction terminates the analysis. One third of the contraction thus determined represents the volume of oxygen contained in the air submitted to analysis, and in this case, as oxygen and nitrogen were the only gases present, the estimation of the former also determines the latter. Such an analysis as that which we have described is termed a direct determination; in other cases, we employ an indirect method.

1. The method of direct determination is applicable to mixtures of the following gases: carbonic acid, oxygen, olefiant gas, and carbonic oxide. If all these gases are present in the specimen to be analyzed, a few drops of a concentrated solution of potash is introduced into the apparatus, after a measured quantity of the gas has been transferred

to it as before; the carbonic acid is speedily absorbed by the potash, and converted into carbonate of potash. The remaining gas is remeasured at the same pressure as before, and the difference of the two measurements represents the volume of the carbonic acid that was present. The remaining gas is next brought into contact with a few drops of a strong solution of pyrogallic acid, which is introduced into the apparatus. In a few minutes, the whole of the oxygen is absorbed by the acid solution, which assumes a deep blood-red color. The remeasurement of the gas at the original pressure gives the volume of oxygen in the mixture.

The absorption of the olefiant gas is effected by the introduction into the tube I of a coke-bullet saturated with a solution of anhydrous sulphuric acid in oil of vitriol. This absorption occupies far more time than that of the preceding gas, an hour or more being required, and the residual gas contains sulphuric acid and the vapor of anhydrous sulphuric acid, which must be removed by a few drops of a strong solution of potash. The residual gas being again measured in F, the diminished pressure represents the volume of olefiant gas. The carbonic oxide is then determined by a solution of dichloride of copper, which is best prepared by allowing a concentrated solution of the protochloride to be in contact with copper turnings in a stoppered bottle for some days. The gas must be brought in contact for ten minutes with a little of this solution, introduced into the apparatus. The pressure of the gas is again measured, and determines the volume of carbonic oxide that has been absorbed. This gas is, however, usually determined by the indirect method.

2. The method of indirect determination is especially applicable to mixtures of the following gases: hydrogen, light carbureted hydrogen, carbonic oxide, and nitrogen. We explode a known volume of the mixture of these gases in the tube F, with an excess of oxygen, and determine (1) the diminution of volume after the explosion, and (2) the volume of carbonic acid produced by the combustion. The gas that remains after the absorption of the carbonic acid (by a solution of potash), consists merely of nitrogen, with any excess of oxygen beyond what was necessary. The volume of oxygen determined by explosion with hydrogen, subtracted from the residual gas, gives the amount of nitrogen contained in the mixture. For the determination of the respective volumes of nitrogen, hydrogen, carbonic oxide, and light carbureted hydrogen, we have the following data—viz. (1) the volume of the gas taken for analysis, which we will call A; (2), the volume of the combustible gases contained in it, which we will call A′, and which is ascertained by deducting from A the amount of nitrogen determined as above; (3), the contraction of volume on explosion, which we will call C; and (4) the volume of carbonic acid generated on explosion, which we will call D; and we likewise know that on exploding one volume of hydrogen with an excess of oxygen, the contraction of volume is expressed by 1.5; that on similarly exploding one volume of carbonic oxide, the contraction is expressed by 0.5, while one volume of carbonic acid is produced; and that with light carbureted hydrogen the contraction is represented by 2.0, while one volume of carbonic acid is produced. Hence, if we call w, x, y, z, the unknown volumes of nitrogen, hydrogen, carbonic oxide, and light carburetted hydrogen, we see at once that $w = A - A'$, and $x = A' - D$; and the above numerical data give us the equations.

$$C = \frac{3x}{2} + \frac{y}{2} + 2z, \text{ and } D = y + z; \text{ whence } y = \frac{3A' - 2C + D}{3}, \text{ and } z = \frac{2D - 3A' + 2C}{3},$$

which affords the complete solution of the analytical problem.

If, on the application of these formulæ to the results of an analysis, one of the quantities w, x, y, z is found $= 0$, or a small negative result, it obviously follows, that the gas whose volume is represented by the letter in question, is not present in the mixture.

For further details regarding this somewhat difficult branch of chemical analysis, we must refer to Bunsen's treatise, and to the articles "Analyze für Gase," in the second edition of Liebig, Poggendorff, and Wöhler's *Handwörterbuch der Chemie;* and "Gasometric Analysis," in the *English Cyclopædia*—Arts and Sciences, vol. iv.

GAS (LIGHTING BY) is the best and most economical mode of obtaining artificial light as yet brought into use; though hardly known at the beginning of the present century, it has since been gradually extending. It may now be said to be universal in the cities and towns of Europe; it is making rapid progress throughout America, where it has long been used in the principal cities of the United States and of Canada. Its introduction into Asia has been more recent, and its progress there, as might have been expected, is much slower. It has also been introduced into the principal towns in Australia and Tasmania.

From 1658 to 1739, the attention of men of science in England had been repeatedly turned to the streams of inflammable air issuing from wells and mines in the coal districts, various communications on the subject having been read before the royal society of London. In the last-mentioned year, the Rev. Dr. John Clayton, dean of Kildare, gave an account of experiments in which he had distilled gas from coal. It was not, however, till 1792 that the possibility of applying gas, distilled from coal, to the production of artificial light was demonstrated. In that year, Mr. William Murdoch constructed apparatus by which he lighted his house and offices at Redruth, in Cornwall. In 1798, he lighted part of the manufactory of Messrs. Bolton and Watt at Soho; and in 1805 he lighted the cotton-mills of Messrs. Phillips and Lee at Salford. A proposal was

made by M. Le Bon to light a portion of Paris with gas in 1802. In the succeeding year, Mr. Winsor commenced lecturing on the subject in London. He being a man of a sanguine and enthusiastic temper, his strong statements probably tended to retard rather than advance the new art. He promised to every depositor of £5 an income exceeding £500 per annum, and he urged the government to take the matter into their own hands, as a certain means not only of clearing off the national debt, but of securing a permanent and large revenue to the country. The chartered gas company of London, which was the first company incorporated, obtained their act of parliament in 1810. At that time, Mr. Winsor, who had been instrumental in establishing the company, was employed by them; but in 1813 they found it necessary to engage the late Mr. Samuel Clegg, who, from the year 1805, had been engaged in promoting the use of gas, and to whose ingenuity and scientific skill the chartered company, as well as the community, were greatly indebted. Mr. Clegg was the inventor of the hydraulic main, of the wet-lime purifier, and of the wet gas-meter, all which were essential to the success of gas-lighting.

As the first gas applied to artificial lighting was obtained from coal, so, owing to the economy attending its manufacture, the use of any other material only occurs when coal cannot be obtained except at an exorbitant price, and where other gas-yielding materials are unusually cheap. Resin and oils are the best substitutes for coal. Many schemes have recently been started for supplanting coal-gas by air charged with vapor of volatile hydrocarbon fluids, such as petroleum spirit; also for improving coal-gas, and rendering hydrogen gas, derived from water, suitable for illuminating purposes. None of these has as yet attained such success as to enter into permanent competition with coal gas; but some of them are used in large hotels in America, and by other large establishments in localities where coal-gas is not easily procured.

Destructive distillation by the action of heat is in all cases the means employed to disengage the gas from coal. The manufacture of coal-gas is likely to continue the most general process for producing artificial light; and the modes of storing, distributing, and using the various substitutes which have been proposed, being similar to those applied to coal-gas, it is unnecessary to enter into details with regard to them.

As a branch of manufacturing industry, coal-gas-works occupy an important position, not only from the immense capital permanently embarked, and the great number of hands employed in them, but also from the demand created by them for coal, lime, etc., and for iron-work, brass-work, and gas-meters. In London alone, the aggregate share and borrowed capital of the nine companies supplying the metropolitan district amounts to nearly nine and a half millions sterling. The success of recent methods of applying the electric light has seriously depreciated the value of shares in gas companies. In England, there are above 400 gas companies; in Scotland, above 180; in Ireland, above 60, besides about 130 gas-works belonging to individuals or corporations. The coals best adapted for the manufacture of gas are those called in England cannel coals, and in Scotland parrot coals. The English caking coals, mostly got near Newcastle-on-Tyne, are, however, from their cheapness and the superior quality of the coke which remains after distillation, more extensively used than any other. In Scotland, parrot coals, till the recent changes in the coal-trade, were used exclusively. Cannel is used extensively in Liverpool, Manchester, and some other towns; a proportion of cannel or of Scotch parrot is used with caking coal in London, Dublin, and other places to improve the quality of the gas, but in England generally the gas is made from caking coal. The coke of the English cannel coals is of fair quality, though inferior to that of the caking coals. The coke of the Scotch parrot coals is very inferior, that of some being altogether worthless.

It may be premised that, in comparing the illuminating power of one gas with another, the standard of comparison is the light from a sperm candle burning 120 grains of sperm per hour, the gas-burner consuming at the rate of 5 cubic ft. per hour. When the quantities consumed are different from these, the results are rectified by calculation.

The English caking coals yield from 8,000 to 10,000 cubic ft. of gas per ton, of illuminating power varying from 12 to 14 sperm candles to a burner consuming 5 ft. per hour. The English cannel coals yield about 10,000 cubic ft. per ton, of illuminating power varying from 20 to 24 sperm candles. The Scotch parrot coals are very various in quality, yielding from 8,000 up to 13,000 cubic ft. per ton, varying in illuminating power from 20 up to 35 candles. As a general rule, the parrot coals which yield the greatest quantity of gas, yield also gas of the highest illuminating power. Bituminous shales may be used in part to supply the place of cannel coals. They yield from 6,000 to 8,000 ft. of gas, varying from 34 to 40 candles.

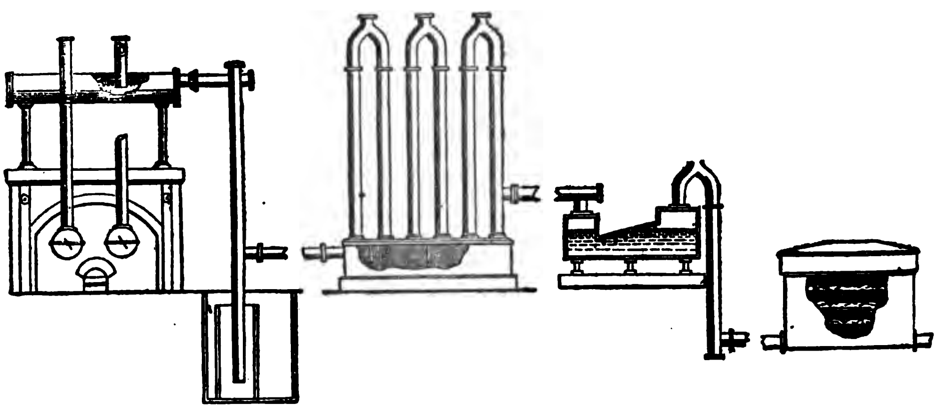
In the process of distillation, gas, tar, and ammoniacal liquor come off together, and are separated by the action of the apparatus employed—a large residuum of coke remains in the retort. The gas consists of a mixture of heavy carbureted hydrogen (olefiant gas), specific gravity, 985; heavy hydrocarbon vapors of various kinds; light carbureted hydrogen, specific gravity, 555; sulphureted hydrogen, specific gravity, 1191; sulphide or sulphuret of carbon in minute quantity; carbonic oxide, specific gravity, 972; carbonic acid, specific gravity, 1524.

The value of coal-gas depends on the proportion of olefiant gas and heavy hydrocarbons which it contains. Great attention is required in heating the retorts; if their

temperature be too low, the tar and liquor are increased in quantity, and the gas diminished in quantity and deteriorated in quality. If the temperature be too high, the olefiant gas is decomposed, and light carbureted hydrogen formed. While different parts of the apparatus necessary for producing, purifying, storing, and sending out the gas are capable of many variations in size, form, and construction, the order in which they come into use is almost invariable. First there are the *retorts*, *ascension* and *dip pipes*, *hydraulic main;* then the *tar-well* and *condenser*, the exhauster, the washer or scrubber, the *purifier*, the station-meter, the *gas-holder*, and the governor—the parts printed in italics being indispensable. Besides the above, valves of various forms, simple and complicated, are employed. These, in some of their arrangements, display great ingenuity. Water-traps also have to be applied for collecting and removing the water and tar which condense in the pipes. The annexed wood-cut shows an arrangement common in small gas-works.

The retorts are now generally made of fire-clay, though cast-iron retorts are still frequently to be met with. They are made D-shaped, cylindrical, kidney-shaped, and elliptical. The sizes most common are from 6 to 9 ft. in length, and from 12 to 20 in. in diameter. In large works, two 9-ft. lengths are joined together, forming one retort 18 ft. long, with a mouth at each end—a mode of construction which is found to possess considerable advantages. The retort is built horizontally into an arched oven, in such a manner as to be equally heated throughout from a furnace beneath. From one to seven retorts, and sometimes a greater number, are set in the same oven. The open mouth-piece of the retort is of cast-iron, and projects outwards from the front wall of the oven sufficiently far to admit, between the mouth and the front of the oven, an

ELEVATION OF GAS-WORKS.



Retorts, etc. Tar Well. Condenser. Washer. Dry-Lime Purifier.

opening, to which the ascension-pipe is connected for conveying the gas to the hydraulic main. When the coal to be distilled is introduced into the retort, the mouth is closed with a lid, which is kept tight by a luting of clay or other material round the edge, and made fast with a screw.

The hydraulic main is a large pipe made of thick plate or cast-iron. It is first about half-filled with water, which in the course of a short time is entirely displaced by the liquid product of distillation. The dip pipes, which are the continuation of the ascension pipes, dip into the liquid through which the gas bubbles up into the upper portion of the hydraulic main. The gas and liquid come off at the end of the hydraulic main, and flow together till they reach the tar-well, into which the liquid, by its greater gravity, falls. The liquid consists of tar and ammoniacal water. These are withdrawn from the tar-well, and become the raw material from which other products are manufactured. From the tar, naphtha, pitch-oil, pitch, and coke are obtained; and from the water, salts of ammonia are prepared The tar and ammoniacal water being of different densities, are easily separated, by being allowed to settle in a vessel. See GAS-TAR, NAPHTHA, SULPHATE OF AMMONIA, SAL-AMMONIAC, etc When a retort is opened for withdrawing the exhausted charge of coal and renewing it, the pressure of the gas on the hydraulic main forces the liquid to ascend the dip-pipe, and thus seals it against the gas in the hydraulic, which, but for this, would rush up the dip-pipe, descend the ascension-pipe, escape, and ignite at the open mouth of the retort. In the tar-well there is also a dip-pipe, inserted into a deep vessel, to prevent the gas from entering the well. A similar contrivance is resorted to wherever it is necessary to introduce or draw off liquids at any part of the apparatus. The tar-well must be placed so low that all the liquid in the pipes leading to it from the hydraulic main, and from it to the condenser, must incline towards it.

The simplest form of condenser consists of a series of upright pipes, each pair being connected at the top by an arch pipe. These are erected upon a horizontal chest, the top of which has an opening into the bottom of each upright pipe. Immediately under the center of each arch pipe, a plate descends from the top of the chest, and reaches to within a few inches of the bottom. When in operation, the chest is always filled with liquid to such a height, that these plates dip into it, and prevent the gas from passing through the chest horizontally. When admitted into the chest, the gas finds no exit but by ascending the first upright pipe; and, passing over the arch, it descends to the chest again through the second upright pipe. There being no dip-plate between the second and third upright pipes, the gas ascends the third pipe and descends the fourth, and so on through the condenser. The upright pipes are kept cool by exposure to the atmosphere, and sometimes a thin stream of water is caused to flow over them. As the gas ascends and descends, cooling rapidly in its passage, the liquid which has been carried along in a state of vapor, condenses, and falls into the chest, from which it is conveyed back by an overflow-pipe to the tar-well.

The exhauster, when used, is now the next part of the apparatus. It is a species of pump, driven by steam-power, and is made in various forms, both direct-acting and rotary. It serves the purpose of relieving the retorts of the resistance or pressure, created in the passing of the gas through the apparatus, and in raising the gas-holders. The use of the exhauster greatly lessens the deposit of carbon in the retorts in the form of graphite, and is attended with other important advantages.

At this stage of the process, the liquid products have been separated from the gaseous. A portion of the ammonia and the sulphureted hydrogen and carbonic acid have still to be removed. As yet, there are no means practically applicable for the removal of the sulphide of carbon; but the quantity produced is so minute as to be uninjurious. To remove ammonia from the gas, the washer or scrubber is used. In the washer, the gas is forced to pass through water to a depth of several inches, or through a solution containing an ingredient with which the ammonia will combine. The scrubber, which may be used instead of the washer, is an upright vessel, in which the gas is made to pass through brushwood, layers of small stones, coke, or suitable shelving of wood or iron, through or over which water may be made to percolate.

There are two kinds of purifiers—the wet and the dry. Either may be used separately, or they may be used in succession. The wet variety is now rarely to be met with. The dry purifier is a vessel containing a series of perforated trays, on each of which the purifying material is spread. Slaked lime (in the form of dry hydrate) is used in this purifier in layers of from 2½ to 3½ in. on each tray. The lime absorbs the sulphureted hydrogen, a portion of the ammonia, and the carbonic acid. When saturated, it is removed, and the vessel is refilled with fresh material. The refuse lime is useful as a manure. When the oxide of iron is employed as the purifying material, the preparation is spread in the same manner as the lime, but to a much greater thickness. When, by the absorption of sulphureted hydrogen, the oxide of iron has become sulphuret of iron, it is taken out, and, by exposure to the atmosphere, it is reconverted into oxide, and can be used again and again. When oxide of iron is used, a separate lime-purifier is necessary for removing the carbonic acid. A narrow chamber, nearly full of water, runs round the upper edge of the dry purifier; into this chamber the sides of the cover, which is of sheet-iron, are let down, and the gas is thus prevented from escaping.

After passing the purifier, the gas, which is now fit for use, is measured by the station-meter, an instrument similar in principle to the consumers' meter, afterwards described. It is then conveyed to the gas-holder, to be stored and issued as required.

The gas-holder is an inverted cylindrical vessel of sheet-iron, placed in a tank of cast-iron, stone, or brick containing water. A pipe ascends from the bottom of the tank through the water, to admit the gas to the space between the surface of the water and the crown of the gas-holder. Another pipe descends through the water and the bottom of the tank, for the issue of the gas to the main-pipe. The water is for the purpose of retaining the gas within the vessel. The buoyancy of the gas raises the gas-holder; and the weight of the gas-holder, or such part of it as is not taken off by balance-weights, impels the gas through the pipes. When balance-weights are necessary, they are attached to the edge of the crown of the gas-holder by long chains, which pass over pulleys on the top of columns which serve also to guide the motion of the vessel in rising and falling. Gas-holders are constructed of all sizes, some exceeding 200 ft. in diameter. In large establishments, telescopic gas-holders are used, and economy of space and cost are thereby effected—two concentric gas-holders being contained in one tank. The outer vessel of a telescope gas-holder has no crown. The upper edge is turned first inwards and then downwards, forming an inverted hollow chamber. The under edge of the inner vessel again is turned outwards and upwards, forming a hollow chamber, which, when the vessel rises out of the tank, will be full of water. The inner side of the inverted chamber, round the top of the outer vessel, fits into the inside of the chamber round the bottom of the inner vessel, and enters it when that vessel has nearly ascended to the top of the tank. The water in the chamber retains the gas, and the two vessels then rise together. The inner vessel, it will be observed, ascends first; both then ascend and descend together, till the outer vessel has reached the bottom of

the tank, on which it rests, and the inner vessel then also descends into the tank. Three gas-holders, or lifts, as they are termed, are occasionally placed in the same tank.

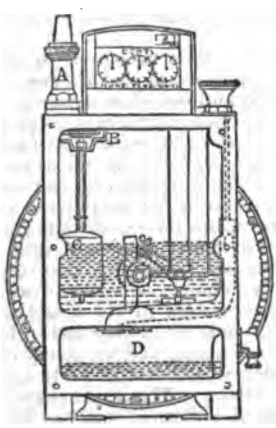
Before reaching the main-pipes, the pressure of the gas is regulated by the governor. In small establishments, the governor is very frequently dispensed with, and the pressure adjusted with sufficient nicety by the regulation of the outlet valve. The governor consists of a small gas-holder, the inlet-pipe to which is placed in the center of the tank, and terminates with a plate having a circular orifice in its center. In this orifice hangs a cone, which is attached to the crown of the small holder. When the gas is issuing slowly, the holder rises, taking with it the cone, and so restricting the orifice by which the gas enters. When the gas issues rapidly, the holder falls, and with it the cone, thereby enlarging the inlet. Many and varied applications of machinery are to be found in the larger gas-works, displaying much mechanical skill, and continuous progress in the adoption of means to economize labor, and to facilitate and improve the manufacture and distribution of gas.

The gas is conveyed from the works by main-pipes of cast-iron, to which branch or service pipes are connected wherever a supply is wanted. The main-pipes require to be skillfully arranged with respect to size, carefully jointed, and laid with as few changes in their inclination as possible; but as such changes are unavoidable, it is necessary to provide for the removal of water, which, flowing along with the gas in the form of vapor, condenses in the pipes, and lodges at low points. For this purpose, a vessel, similar in construction to the tar-well, is connected to the main-pipe, and the water is removed by a pump. When little condensation is anticipated, and when there is no risk of the water affecting the flow of the gas, a small pipe merely is attached to the main, with a stop-cock to run off the water. The service-pipes should incline towards the main; and where this cannot be attained, provision should be made for drawing off water.

Gas-fittings.—The small pipes for fitting up the interiors of houses are either of wrought-iron or of soft metal. To insure permanent efficiency, it is of the utmost importance that these pipes should be *capacious;* they should be laid *evenly*, with an inclination towards the meter; and where the inclination is materially disturbed, a box should be provided for the collection and removal of water.

Gas for street-lighting is usually supplied by contract, a specified burner being used, and the lights being lighted and extinguished at stipulated hours. Lights in private establishments were originally charged for on the same system. The uncertainty of such a mode of charge directed the attention of gas-engineers to the construction of meters at a very early period. Accordingly, in 1816, Mr. Clegg took out his first patent for the wet gas-meter, which, as subsequently improved by Malam, Crosley, and others, came into general use about the year 1822. Dry gas-meters are now extensively manufactured on a principle first patented by Mr. A. A. Croll, a gentleman who has also patented various modifications of the apparatus and processes used in the manufacture and purification of gas, and the utilization of the liquid products.

The wet gas-meter consists of a hollow circular case, somewhat more than half filled with water. The measurement is made by the cylinder, a hollow drum or wheel, which revolves on a horizontal axis inside the case, the elasticity of the gas supplying the motive-power. The cylinder is divided into four chambers by partitions running in a slanting direction from back to front, and presenting a section of a four-threaded Archimedean screw. A convex cover is fixed on one end of the cylinder. This cover has an opening in the center, which admits the pipe by which the gas enters the cylinder; the opening being below the surface of the water, so as to be sealed by it. The pipe, after entering the opening, is turned up, so that its mouth is above the water. The gas thus admitted within the cover, finds its way through a slit into one of the four chambers into which the cylinder is divided. The chamber which first comes into action is at the moment almost entirely under the water. The gas presses between the water and the partition of the chamber, and, in raising the partition, turns the cylinder on its axis, and brings the chamber above the water, filling it at the same time. The outlet slit of the chamber is on the side of the cylinder opposite to the inlet slit, and is open to the case of the meter. It is not, however, directly opposite to the inlet slit, but is so arranged that it remains sealed under water till the chamber is completely filled with gas, by which time the revolution of the cylinder has brought the inlet slit of the next chamber above the water, and it is ready to receive the gas. The filling of the next chamber carries round the one already filled, causes its descent into the water as it revolves, and completely expels the gas by the outlet slit. Two chambers only can be in action at one time. These chambers are



Wet Meter—front box open:

A, entrance pipe; B, valve chamber; C, float, with valve on the upper end; D, surplus or waste-water box.

made with great accuracy, and are liable to no variation but the enlargement caused by the evaporation of the water, and the consequent depression of the water-line. On the front of the case of the meter is placed a box, into which the axis of the cylinder extends, having a spiral worm-wheel on its end. The worm-wheel communicates motion to an upright spindle, which again moves the train of wheels by which the handles of the index are worked. The front box also contains the filling and overflow pipes for the supply and adjustment of the water, the entrance-chamber by which the gas is admitted, and in which the float-valve is placed. This valve is supported and kept open by a float which descends, closes the valve, and shuts off the gas when the water is depressed too much.

An act of the British legislature has been passed, according to which all gas-meters must be so constructed as not to register more than 2 per cent in favor of the seller, and 3 per cent in favor of the purchaser of gas; thus allowing 5 per cent for variation caused by the depression of the water-line on wet gas-meters. All meters fixed since the act came into operation must bear the seal of an inspector appointed under the act.

The dry gas-meter possesses advantages, which, were it in other respects equally reliable with the wet meter, would give it the preference. Once adjusted, it gives no further trouble; it is not liable to derangement in frosty weather; and, in passing through it, the gas takes up no additional moisture to increase the risk of annoyance from deposit of water in the pipes. But doubts are still entertained by many of the durability of the machine as an efficient and correct measure. The meter consists of chambers separated from each other by partitions; generally there are two, but some makers use three chambers. Each chamber is divided into two parts by a flexible partition which moves backwards and forwards, its motion being regulated by valves beautifully contrived for the purpose. The meter bears some resemblance to a double or triple steam-engine. Following out this resemblance, Mr. Croll thus describes his meter: "It consists of a cylinder, divided, by a plate in the center, into two separate cylindrical compartments, which are closed at the opposite ends by metal disks; these metal disks serve the purpose of pistons, and they are kept in their places by a kind of universal-joint adapted to each; the space through which the disks move, and, consequently, the means of measurement, is governed by metal arms and rods, which space, when once adjusted, cannot vary. To avoid the friction attending a piston working in a cylinder, a band of leather is attached, which acts as a hinge, and folds with the motion of the disk; this band is not instrumental in the measuring, so that if it were to contract or expand, the registering of the meter would not be affected, inasmuch as it would only decrease or increase the capacity of the hinge, the disk still being at liberty to move through the required space; the leather is also distributed in such a manner, being curved, and bending only in one direction, that it prevents any wrinkles or creases forming, and renders it therefore much more durable. The arrangement of the valves and arms are somewhat different to that of a steam-engine, although similar in principle."

Consumers of gas should bear in mind, that the purpose of the meter is to inform them how much gas they are expending; and that while the seller of gas cannot visit it but at long intervals, the purchaser may from day to day, if he pleases, ascertain the quantity which has passed through the meter, and so detect irregularity or waste, which, if allowed to go on, would no doubt be put down to error on the part of the seller of gas.

Gas-burners.—The burner made on the argand principle is still the best when carefully used, but it is expensive, somewhat troublesome to keep clean, and involves outlay for glasses from time to time. Jets and batwings have, consequently, almost supplanted it. These burners are now made by machinery at very low prices, so that to change them when out of order costs little, and is easily done. They are also very easily cleaned. Jets are of two kinds—cockspurs and union-jets. The cockspurs are pierced with one or more straight holes; the union-jets are pierced with two holes diverging inwards from the point of issue, so that two small streams of gas impinge on each other, and produce a flat flame. Batwings are made with a clean slit across the head of the burner. The union-jet is by far the most common. Metal burners are very liable to rust and become useless. This difficulty is obviated in the patent burner made of a siliceous composition, which lasts for years without deterioration.

There is one important fact in the burning of gas, which is equally true of animal and vegetable oils. When a given quantity is burnt in a large flame, a greater amount of light is obtained than when the same quantity is burnt in a smaller flame. Hence one large lamp or gas-jet is better than three or four burning the same quantity in the same time. The cause of this becomes apparent by considering what takes place when a jet of gas is turned down to the lowest point. Here the white light altogether disappears, and only a blue flame remains; the small body of gas as it issues becomes mixed and diluted with air, and the whole is perfectly consumed, as in the Bunsen burner, without any of the carbon becoming solid and incandescent. On gradually admitting more gas, a white speck first appears in the middle of the blue, and this speck—the area of imperfect combustion—goes on increasing not only in absolute size, but its proportion to the area of perfect combustion becomes greater as the whole flame is enlarged. The limit to this economy is the quantity that can be burnt without smoke. This difference between large and small flames does not hold in burning paraffin oil.

There are many contrivances for improved burners and improved modes of using gas. Among them are the sunlights, introduced by the late Mr. King of Liverpool. These consist of a ring of union-jets, placed horizontally and set round the interior of the base of a cone which is passed through the ceiling, and conveys away the products of combustion through a flue, thus serving both for lighting and ventilation.

Regulators.—The object of these instruments is to restrict the supply of gas when superabundant, and it should be noticed that the supply requires to be so before any advantage can result from the use of them. A conical valve, operating by the pressure of the gas in a manner similar to the governor at the gas-works, is in general the acting part of the apparatus.

The impurities which should be removed in the manufacture of coal-gas are sulphureted hydrogen, ammonia, and carbonic acid. The presence of sulphureted hydrogen is detected by allowing a stream of the gas to play on a paper wetted with a solution of acetate of lead; the test-paper is blackened if the deleterious gas be present. Ammonia is detected by allowing the gas to play on paper stained yellow with turmeric. Ammonia changes the yellow to brown. The presence of carbonic acid can be ascertained by causing the gas to bubble through lime-water. If carbonic acid be present, it combines with the lime, and the water becomes milky.

The value of gas for lighting depends on its illuminating power, which, again, mainly depends on the proportion of olefiant gas and heavy hydrocarbons contained in the mixture. The specific gravity of the gas would be a complete test of the illuminating power, were it first ascertained that no deleterious gases were contained in the mixture. The chlorine and bromine tests, which are applied by bringing the gas into contact with either of these substances in a graduated tube, also require that the absence of deleterious gases be ascertained. Chlorine and bromine condense the olefiant gas and heavy hydrocarbons, and the proportion of them present is ascertained by the proportion of the gas which is condensed.

The most practical mode of determining the illuminating power is by the use of the Bunsen photometer, introduced into this country by Dr. Lyon Playfair, first adapted by the late Mr. King of Liverpool, and since modified and improved by Dr. Letheby and Mr. F. J. Evans of London. At one end of a straight bar of wood, a gas-burner is mounted; on the other end, a candlestick. These are so placed, that when lighted, there are exactly 100 in. between the centers of the lights. The bar is correctly graduated to show how many times the one light exceeds the other. A circular disk of paper made semi-transparent, excepting a spot in the center, which is left opaque, is placed at right angles across the graduated bar on a stand which slides along the bar. When the disk is moved into a position where the opaque spot is invisible, the lights are equal—the disappearance of the spot being caused by the light transmitted by the semi-transparent part of the disk being equal to that reflected by the opaque part. The figures immediately below the disk indicate the power of the light.

As has been stated, the illuminating power of coal-gas may vary from 12 sperm candles up to nearly 40, though neither extreme is supplied to consumers. In England, quality varies from 14 to 22 candles; in Scotland, from 22 to 32 candles. The cost of production is affected by causes independent of the illuminating power, and these are so various, that the cost can hardly be the same in any two places. In contrasting the price of gas in different places, another difficulty arises from the unavoidable variation in the quantity accounted for; the loss sustained under the head of condensation, leakage, bad debts, and waste, varies from 10 up to 30 per cent on the whole quantity made; and though, when this loss is excessive, the remedy should, to a certain extent, be in the power of the manufacturer, yet there is a considerable range within which the loss may vary, owing to local and peculiar circumstances which the manufacturer cannot control.

The economy of gas for lighting purposes will be apparent when it is considered that 50 ft. of gas consumed in a burner at 5 ft. per hour, will last 10 hours; while a sperm candle of six to the pound, and burning 120 grains per hour, will only last 9.722 hours. Assuming, however, that both will last 10 hours—a view which is in favor of the candle—1000 cubic ft. will last as long as 20 candles; therefore, with an illuminating power of 15 candles, it will give an amount of light equal to 300 candles, or 50 lbs., which at 2*s.* per lb. would cost £5; at 20 candles it would equal 400, or 66⅔ lbs., costing £6 13*s.* 4*d.*; at 25 candles it would equal 500, or 83⅓ lbs., costing £8 6*s.* 8*d.*; at 30 candles, it would equal 600, or 100 lbs., costing £10.

The relative illuminating value of different oils and of coal-gas formed the object of a series of careful experiments recently made by Dr. Stevenson Macadam, lecturer on chemistry in Edinburgh; and the following are some of the results, bearing more especially on the relative cost of the various sources of artificial light. The standard of comparison is the sperm candle above described; an hour of such a candle is assumed as the unit of light supply, and is called *a candle-hour.*

Candles.—Taking the price of tallow, composite, and paraffin at 6*d.*, 8*d.*, and 1*s.* respectively—

Tallow will give	7.29	candle-hours for 1*d.*
Composite "	6.19	" "
Paraffin "	6.36	" "

Animal and Vegetable Oils.—Burnt in a flat-wick lamp—

Sperm oil gives	4.69	candle-hours	for 1*d.*
Rape-oil "	7.18	"	"
Whale-oil "	8.56	"	"

Burnt in an argand lamp—

Sperm-oil gives	8.99	candle-hours	for 1*d.*
Rape-oil "	14.17	"	"
Whale-oil "	15.42	"	"

Paraffin Oil.—At 2*s.* per gallon, paraffin oil gives 53.33 candle-hours for 1*d.*; at 1*s.* 6*d.* per gallon it gives 71.11 candle-hours for 1*d.*

Coal-gas.—In experimenting with coal-gas, the standard assumed was a gas which, with a burner consuming 5 cubic ft. an hour, gave the light of 28 sperm candles. This burner is called No. 5, and the others, Nos. 4, 3, 2, 1, 0.5, are such as under a regulated pressure pass 4, 3, etc., cubic ft. an hour respectively.

Tabular Result.—With standard gas at 5*s.* per 1000 ft.

No. 5 jet gives	93.33	candle-hours	for 1*d.*
" 4 "	86.66	"	"
" 3 "	76.66	"	"
" 2 "	65	"	"
" 1 "	50	"	"
" ½ "	33.33	"	"

Coal-gas is thus cheaper than paraffin, when the gas is burnt in large jets; but dearer in small jets.

It is necessary to observe that giving equal quantities of light is not the real measure of economy, because no one is contented to take no more light from gas than from other modes of lighting; and the gas-lights being fixed, more light is requisite in order to compensate the loss of the convenience afforded by a movable light. Five feet per hour of 15 candle-gas will fully supply the place of a pair of sperm candles, costing 8*d.* for 10 hours' light; while the gas at 5*s.* per 1000 ft. would only cost 3*d.* for the same time, and would yield a light 7½ times as great.

The use of gas for heating and cooking is becoming extensive. Its great recommendations are facility of regulation, readiness of application, and perfect cleanliness. In roasting by gas, the juices are retained in the meat to a greater extent than by the ordinary process; while in all the operations, the heat can be regulated with so much nicety, as greatly to aid the cook in presenting the food in the most wholesome and agreeable condition.

Besides brilliancy of light, safety and cleanliness attend the use of gas. Explosions under ordinary circumstances are hardly possible—the escape of gas is quite disagreeably perceptible by the smell when there is one three-thousandth part present in the atmosphere; and there can be no explosion unless with, at the least, 200 times that quantity, or 1 part in 15. Such accumulations will, and do undoubtedly, take place in confined situations, but ordinary precaution in avoiding the use of a light will avert the risk of accident. Gas, having a tendency to ascend, escapes near the ceiling of an apartment are more likely to form an explosive mixture than escapes occurring low down. Repeated accidents have happened through forgetfulness of this. It should be remembered that the situation must be considered a confined one when the gas is prevented from ascending freely. The standard work on gas-lighting is that by the late Samuel Clegg, Jun., son of the inventor of the gas-meter, published by John Weale, London. There is also a smaller work by the same publisher, written by Samuel Hughes, C.E.

GASCOIGNE, GEORGE, 1535–77; one of the pioneers of Elizabethan poetry, was the son and heir of Sir John Gascoigne. He studied at Cambridge, and was admitted to Gray's Inn in 1555. His youth was unsteady, and his father disinherited him. In 1565, he had written his tragi-comedy of *The Glass of the Government*, not printed until 1576. In 1566, his first published verses were prefixed to a book called *The French Littleton*, and he brought out on the stage of Gray's Inn two very remarkable dramas, *Supposes*, the earliest existing English play in prose, and *Jacosta*, the first attempt to naturalize the Greek tragedy. Of the latter only the second, third, and fourth acts were from his hands. Soon after this he married. In 1572, there was published *A Hundred Sundry Flowers bound up in one small Posy*, a printed collection of Gascoigne's lyrics, he having started in March of that year to serve as a volunteer under the prince of Orange. He was wrecked on the coast of Holland and nearly lost his life, but obtained a captain's commission, and acquired considerable military reputation. An intrigue, however, with a lady in the Hague, nearly cost him his life. He regained his position, and fought well at the siege of Middleburg, but was captured under the walls of Leyden, and sent back to England after an imprisonment of four months. In 1575, he issued an authoritative edition of his poems under the name of *Posies*. In the summer of the same year, he devised a poetical entertainment for queen Elizabeth, then visiting Kenilworth; this

series of masques was printed in 1576 as the *Princely Pleasures*. Later on in 1575, he greeted the queen at Woodstock with his *Tale of Hemetes*, and presented her on next New Year's day with the MS. of the same poem, which is now in the British museum. He completed in 1576 his two most important works, *The Complaint of Philomene*, and *The Steel Glass*, the first of which had occupied him since 1562; they were printed in single volume. Later on in the same year, he published *A Delicate Diet for Dainty-mouthed Drunkards*. He fell into a decline and died at Stamford. We are indebted for many particulars of his life to a rare poem published in the same year by George Whetstone, and entitled *A Remembrance of the Well-employed Life and Godly End of George Gascoigne, Esquire*. In his poem of *The Steel Glass*, in blank verse, Gascoigne introduced the Italian style of satire into our literature. He was a great innovator in point of metrical art, and he prefixed to the work in question a prose essay on poetry, which contains some very valuable suggestions. His great claim to remembrance was well summed up in the next generation by Thomas Nash, who remarked in his preface to Green's *Menaphon*, that "Master Gascoigne is not to be abridged of his deserved esteem, who first beat the path to that perfection which our best poets aspired to since his departure, whereto he did ascend by comparing the Italian with the English." [*Encyc. Brit.*, 9th ed.]

GASCOIGNE, Sir WILLIAM, an eminent English judge, belonging to a noble Norman family, was b. at Gaythorpe, Yorkshire, in 1350. After studying for the bar, he acquired considerable reputation as a pleader, and in 1398 was made serjeant-at-law. On the accession of Henry IV. in 1399, he was appointed one of the justices of the court of common pleas; and in 1401, was promoted to be chief-justice of the king's bench. In this high office he distinguished himself both by integrity and ability, and in the older English law reports are many abstracts of his opinions, arguments, and decisions. In July, 1403, he was joined with the earl of Westmoreland in a commission for levying forces against the insurrection of Henry Percy, the celebrated Hotspur He was also nominated one of the commissioners to treat with the rebels. On this and another memorable occasion, he acted with a courage and rectitude which evinced that he was guided by the true spirit of judicial independence. On the apprehension of Scroop, archbishop of York, he refused, at the command of the king, to sentence that prelate to death as a traitor, because the law gave him no jurisdiction over the life of an ecclesiastic. Henry respected his uprightness, and knighted him the same year. When one of the dissolute associates of the prince of Wales was arraigned before him for felony, the prince imperiously demanded his release, and on being ordered to leave the court, he rushed furiously up to the bench, and, it is recorded, struck the chief-justice on the judgment-seat. Gascoigne immediately committed him to prison, when the prince, sensible of his misconduct, at once submitted. On being informed of the circumstance, the king thanked God for having given him "both a judge who knew how to administer the laws, and a son who respected their authority." Gascoigne was called to the first parliament of Henry V., but died the same year, Dec. 17, 1413. He was twice married, and left numerous descendants by both his wives.

GASCON—GASCONNADE. The term *Gascon* is now employed, in the French language, to denote a boaster or braggart, and *Gasconnade* to signify any extravagant or absurd vaunting—the inhabitants of the district once known as Gascony having long been notorious in this respect. An example may be given: a Gascon, on a visit to Paris, was asked by his city-friend what he thought of the colonnade of the Louvre. His reply was: "Ah, it's not bad; it resembles pretty closely the back part of the stables at my father's castle!" There are in French, volumes filled with the original sallies of these humorous boasters.

GASCONADE, a river of North America, rises in the s. of the state of Missouri, and, after flowing n.e. for 250 m., joins the river Missouri about 40 m. below Jefferson City. It flows through a hilly country, covered with forests of pine and other timber, and rich in picturesque scenery. Great rafts of yellow pine lumber are floated down the river annually.

GASCONADE, a co. in e. central Missouri on the Missouri river, with the Missouri Pacific railroad on its w. border, 540 sq.m.; pop. '70, 10,093—80 colored. Surface uneven and mostly covered with timber. Chief products, wheat, corn, oats, and grapes. There are valuable quarries of burr-stone. Co. seat, Hermann.

GASCONY (Lat. *Vasconia*), formerly a district in the s.w. of France, was situated between the bay of Biscay, the river Garonne, and the western Pyrenees, and is now included in the departments of Landes, Gers, Hautes Pyrénées, and the southern portions of Haute Garonne, Tarn-et-Garonne, and Lot-et-Garonne. It derived its name from the Basques or Vasques, who, driven by the Visigoths from their own territories on the southern slope of the western Pyrénées, crossed to the northern side of that mountain-range in the middle of the 6th c., and settled in the former Roman district of Novempopulana. In 602, after an obstinate resistance, the Vasques were forced to submit to the Franks. They now passed under the sovereignty of the dukes of Aquitania

who for a time were independent of the crown, but were afterwards conquered by king Pepin, and later by Charlemagne. Subsequently it became incorporated with Aquitania (q. v.).

GAS-ENGINE. Many attempts have been made to utilize, as a motive-power, the expansive force arising from the explosion of a mixture of common coal-gas, such as is in general use for illuminating purposes, and common air. The first attempt of this kind which had any commercial success was that of Lenoir, a French inventor. It resembles in its general features an ordinary horizontal steam-engine. It has two slides, one on each side of the cylinder, which are opened and closed by eccentrics in the usual way. Through one of the slides, air and gas flow into the cylinder, in the proportions of about 11 of air to 1 of gas, until the cylinder is nearly half full, when the connection with the galvanic battery is made by the revolution of the shaft, causing a spark inside the cylinder, and consequent explosion of the mixture of air and gas. This explosion forces the piston from the middle of the cylinder to the further end. The products of the explosion then escape from the cylinder by the other slide-valve, which opens at the proper instant. The momentum which the fly-wheel has now acquired will carry the piston back to the middle of the cylinder, sucking in behind it, through openings, which are made by the action of the eccentric on the slide, a fresh supply of air and gas; and when the piston has reached to the middle of the cylinder, the further inflow of air and gas is stopped by the slide closing, and at the same instant a spark of electricity is sent into the air and gas, exploding it as before. The first half of the stroke of the piston is thus employed in sucking in the requisite quantities of air and gas, and the last half of the stroke giving off the power arising from the explosion of the mixture of air and gas. Better gas-engines than Lenoir's are now in use, and one of the best is styled the "Otto" silent gas-engine. In several respects it resembles Lenoir's, but it differs from it in others. Instead of an electric spark, a small constantly burning gas flame is used to fire the charge. But the main difference lies in the use of a more dilute mixture of gas and air, placed under a pressure of about 30 lbs. above the atmosphere, by which only a portion of the charge becomes combustible; the remainder is simply expanded, and so not only is the shock of a full explosion avoided, but there is a more sustained pressure on the piston throughout the stroke. In default of a diagram, we may compare the interior of the cylinder to that of a soda-water bottle with straight sides lengthwise, only it has no constricted portion or neck. One third of its length at the bottom end is taken up by the combustion chamber; another third by the piston; and the remaining third or rather more by the space over which the piston travels. A jacket of cold water surrounds the cylinder to keep it cool. There are two openings in the combustion chamber—one for the admission of the charge, and the other for the escape of the products of combustion. Attached to the combustion chamber there is a slide-valve whose movements are so arranged that it first admits the air and gas in due proportions, which the return of the piston compresses, and then another movement of the valve fires the mixture by exposing it to the gas-flame. The explosion, so to call it, occurs once in two revolutions when the engine is fully loaded, but less often when it is not. In the Otto it acts on the piston at the beginning, not as in the Lenoir at the middle of the stroke; but the piston is connected in a similar way with the fly-wheel, in both engines. The cost for gas is about one penny per hour per horse-power.

GASES, GENERAL PROPERTIES OF. The term gas—which is from the same root as ghost, Ger. *geist*, breath, spirit—was employed by the older chemists to designate any kind of air or vapor. Van Helmont was the first chemist who limited the term gas to such elastic fluids as had not been rendered liquid or solid by a reduction of temperature. In common language a distinction is made between gases and vapors. Gases are understood to be invariably aëriform at ordinary temperatures and atmospheric pressures, while vapors under these conditions are solid or liquid, and only assume a vaporous or apparently gaseous form at relatively high temperatures. Thus oxygen, hydrogen, nitrogen, chlorine, etc., are considered true gases; while water, sulphur, iodine, etc., when heated to certain definite points, become transformed into vapors. There is, however, no distinction between gases and vapors in a theoretic point of view.

The *kinetic theory of gases*, first put forth by Daniel Bernouilli, is to the effect that they are formed of material particles, free in space, and actuated by very rapid rectilinear movements, and that the tension of elastic fluids results from the shock of their particles against the sides of the containing vessels. This theory has been recently revived and developed chiefly by Clausius and Clerk Maxwell. Their perfect elasticity is one of the most important physical peculiarities of gases. Within the limits of all ordinary experiments it is generally true that "the volume of a gaseous body is inversely as the compressing force." See MARIOTTE'S LAW.

In consequence of their extreme elasticity, gases exhibit an entire absence of cohesion among their particles, and in this respect they differ essentially from liquids. A vessel may be filled either partially or completely with a liquid, and this liquid will have a definite level surface or limit. With gases, it is otherwise; they always perfectly fill the vessel that contains them, however irregular its form. Instead of cohesion, there is

a mutual repulsion among their particles, which have a continual tendency to recede further from each other, and thus exert a pressure in an outward direction upon the sides of the vessel in which the gas is inclosed. This outward pressure is greater or less according as the elasticity of the gas is increased or diminished.

Dalton long ago remarked that "there can scarcely be a doubt entertained respecting the reducibility of all elastic fluids, of whatever kind, into liquids; and we ought not to despair of effecting it at low temperatures and by strong pressure exerted upon the unmixed gases." This prediction has been completely fulfilled. It occurred to Faraday, who led the van in these investigations, that the most probable mode of obtaining gases (or rather what, under ordinary circumstances, would be gases) in the liquid state, would be to generate them under strong pressure. When thus produced in strong bent glass tubes, they continued liquid at low temperatures while the pressure was maintained; but on removing the pressure (breaking the tube), they instantly passed into the gaseous state. In his memoir, published in the *Philosophical Transactions* for 1823, he announced that he had succeeded in liquefying chlorine, euchlorine, sulphureted hydrogen, nitrous oxide, cyanogen, ammonia, and hydrochloric, sulphurous, and carbonic acids. Subsequently, by the joint action of powerful mechanical pressure and extreme cold, the number of liquefiable gases was so far extended as to include all except oxygen, hydrogen, nitrogen, nitric oxide, and coal-gas; and the following gases were obtained in a solid form—hydriodic acid, hydrobromic acid, sulphurous acid, sulphureted hydrogen, carbonic acid, cyanogen, ammonia, euchlorine, fluoride of silicon.

The researches of Andrews established the fact that for every gas there is a certain minimum temperature at which the energy of the molecular movement is exactly balanced by the force of cohesion, *whatever be the pressure to which the vapor is subjected;* this temperature is the "critical point" of the gas. It was because the critical points of certain gases are very low that they so long resisted all efforts to condense them. No amount of pressure without the necessary cold could be effectual. At last, in the end of 1877, by the use of powerful apparatus and ingenious contrivances for producing cold, the difficulties have been overcome by MM. Cailletet and Raoul Pictet of Geneva. By combining a cold of 120° to 140° below zero, with enormous pressures of 550 and even 650 atmospheres, M. Pictet was able to liquefy oxygen. "He has also liquefied and even solidified hydrogen, which he has seen to issue from the tube in the form of a steel-blue liquid jet, which partly solidified. The solid hydrogen, in falling on the floor, produced the shrill noise of a metallic hail, thus confirming the bold and ingenious idea of Faraday, who first suggested that hydrogen is a metal." The distinction between permanent and condensable gases is thus abolished.

As a point of historical interest, we may mention that many years before the publication of Faraday's earliest researches on this subject, sulphurous acid gas had been liquefied by Monge and Clouet, ammonia by Guyton Morveau, and arseniureted hydrogen by Stromeyer, by the simple application of cold, without any increased pressure.

The expansion and contruction of gases by changes of temperature is treated of under HEAT.

The process of intermixture in gases, and the movements of these substances generally, have been very carefully studied by Faraday, Döbereiner, Mitchell, Bunsen, and especially Graham. These movements are usually considered under four heads, viz.: 1. *Diffusion*, or the intermixture of one gas with another; 2. *Effusion*, or the escape of a gas through a minute aperture in a thin plate into a vacuum; 3. *Transpiration*, or the passage of different gases through long capillary tubes into a rarefied atmosphere; 4. *Osmosis*, or the passage of gases through diaphragms.

In the article *Diffusion* (q.v.), the general principles of this kind of movement in gases are sufficiently explained, and we shall merely make one or two supplementary remarks, chiefly with the view of rendering the following table more intelligible. Graham's experiments with the simple diffusion-tube show (see Graham's memoirs in the *Transactions of the Royal Societies of London and Edinburgh*, or Miller's *Chemical Physics*) that the diffusiveness or *diffusion volume* of a gas is in the inverse ratio of the square root of its density; consequently, the squares of the times of equal diffusion of the different gases are in the ratio of their specific gravities. Thus, the density of air being taken as the standard of comparison at 1, the square root of that density is 1, and its diffusion volume is also 1; the density of hydrogen is 0.0692, the square root of that density is 0.2632, and its diffusion volume is $\frac{1}{0.2632}$, or 3.7994; or, as actual experiment shows, 3.83—that is to say, if hydrogen and common air be placed under circumstances favoring their mutual diffusion, 3.83 volumes of hydrogen will change place with 1.00 of air. The following table gives: 1. The density; 2. The square root of the density; 3. The calculated, and 4. The observed velocity of diffusion or diffusiveness of several important gases; the numbers in the last column, headed "Rate of Effusion," being the results obtained by experiment upon the rapidity with which the different gases escape into a vacuum through a minute aperture about $\frac{1}{100}$ of an inch in diameter.

Gas.	Density.	Square root of density.	Calculated velocity of diffusion.	Observed velocity of diffusion. Air = 1.	Rate of effusion.
Hydrogen..................	0.06926	0.2632	3.7994	3.83	3.613
Light carbureted hydrogen..	0.559	0.7476	1.3375	1.344	1.322
Carbonic oxide.............	0.9678	0.9837	1.0165	1.0149	1.0123
Nitrogen...................	0.9713	0.9859	1.0147	1.0143	1.0164
Olefiant gas...............	0.978	0.9889	1.0112	1.0191	1.0128
Binoxide of nitrogen	1.039	1.0196	0.9808		
Oxygen	1.1056	1.0515	0.9510	0.9487	0.950
Sulphureted hydrogen.......	1.1912	1.0914	0.9162	0.95	
Protoxide of nitrogen.......	1.527	1.2357	0.8092	0.82	0.834
Carbonic acid..............	1.52901	1.2365	0.8087	0.812	0.821
Sulphurous acid	2.247	1.4991	0.6671	0.68	

"The process of diffusion," says prof. Miller, "is one which is continually performing an important part in the atmosphere around us. Accumulations of gases which are unfit for the support of animal and vegetable life are by its means silently and speedily dispersed, and this process thereby contributes largely to maintain that uniformity in the composition of the aërial ocean which is so essential to the comfort and health of the animal creation. Respiration itself, but for the process of diffusion, would fail of its appointed end, in rapidly renewing to the lungs a fresh supply of air, in place of that which has been rendered unfit for the support of life by the chemical changes which it has undergone."

A reference to the last two columns of the above table shows that, within the limits of experimental errors, the rate of effusion of each gas coincides with its rate of diffusion.

Graham's experiments show that the velocity of *transpiration* (the term which that chemist applied to the passage of gas through long capillary tubes) is entirely independent of the rate of diffusion, or of any other known property. It varies with the chemical nature of the gas, and is most probably "the resultant of a kind of elasticity depending upon the absolute quantity of heat, latent as well as sensible, which different gases contain under the same volume; and therefore will be found to be connected more immediately with the specific heat than with any other property of gases." Oxygen is found to have the lowest rate of transpiration. Taking its transpiration velocity at 1, that of air is 1.1074; of nitrogen, 1.141; of carbonic acid, 1.369; of sulphureted hydrogen, 1.614; of ammonia, 1.935; of olefiant gas, 1.980; and of hydrogen, 2.288.

In the passage of gases through diaphragms, the law of the diffusion of gases is more or less disturbed or modified according to the force of adhesion in the material of which the diaphragm is composed; the disturbance being greatest in the case of soluble gases and a moist thin diaphragm, such as a bladder or a rabbit's stomach. For details on this subject we must, however, refer to the article Osmose.

All gases are more or less soluble in water and other liquids. Some gases, as, for example, hydrochloric acid and ammonia, are absorbed by water very rapidly, and to a great extent, the liquid taking up 400 or 600 times its bulk of the gas; in other cases, as carbonic acid, water takes up its own volume of the gas; whilst in the case of nitrogen, oxygen, and hydrogen, it does not take up more than from $\frac{1}{25}$ to $\frac{1}{50}$ of its bulk. "As the elasticity of the gas," says prof. Miller, "is the power which is here opposed to adhesion, and which at length limits the quantity dissolved, it is found that the solubility of each gas is greater, the lower the temperature, and the greater the pressure exerted upon the surface of the liquid. Dr. Henry found that at any given temperature the *volume* of any gas which was absorbed was uniform, whatever might be the pressure; consequently, that the *weight* of any given gas absorbed by a given volume of any liquid at a fixed temperature, increased directly with the pressure. If the pressure be uniform, the quantity of any given gas absorbed by a given liquid is also uniform for each temperature; and the numerical expression of the solubility of each gas in such liquids, is termed its *coefficient of absorption* or *of solubility*, at the particular temperature and pressure, the volume of the gas absorbed being in all cases calculated for 32° F., under a pressure of 29.92 in. of mercury. Thus, 1 volume of water at 32°, and under a pressure of 29.92 in. of the barometer, dissolves 0.04114 of its volume of oxygen; and this fraction represents the coefficient of absorption of oxygen at that temperature and pressure. Similarly, the coefficient of absorption of common air is 0.02471. In consequence of this solubility of the air, all water contains a certain small proportion of it in solution; and if placed in a vessel under the air-pump, so as to remove the atmospheric pressure from its surface, the dissolved gases rise in minute bubbles. Small as is the quantity of oxygen thus taken up by water from the atmosphere, it is the means of maintaining the life of all aquatic animals. If the air be expelled from water by boiling, and it be covered with a layer of oil, to prevent it from again absorbing air, fish or any aquatic animals placed in such water quickly perish. Even the life of the superior animals is dependent upon the solubility of oxygen in the fluid which moistens the air-tubes of the lungs, in consequence of which this gas is absorbed into the mass of the blood, and circulation through the pulmonary vessels."

The following table, drawn up from the researches of Bunsen and Carius, shows the solubility of some of the most important gases, both in water and alcohol:

Gas.	Volume of each gas dissolved in 1 volume of water.		Volume of each gas dissolved in 1 volume of alcohol.	
	At 32 degrees F.	At 59 degrees F.	At 32 degrees F.	At 59 degrees F.
Ammonia	1049.69	727.2		
Hydrochloric acid	505.9	458.0		
Sulphurous acid	68.861	43.564	328.62	145.55
Sulphureted hydrogen	4.3706	3.2326	17.181	9.539
Chlorine	Solid.	2.368		
Carbonic acid	1.7967	1.002	4.3295	3.1993
Protoxide of nitrogen	1.3052	0.0778	4.1780	3.2678
Olefiant gas	0.2563	0.1615	3.5950	2.8825
Binoxide of nitrogen			0.31606	0.27478
Marsh gas	0.05449	0.03909	0.52259	0.48280
Carbonic oxide	0.03287	0.02432	0.20443	0.20443
Oxygen	0.04114	0.02989	0.28397	0.28397
Nitrogen	0.02035	0.01478	0.12634	0.12142
Air	0.02471	0.01795		
Hydrogen	0.01930	0.01930	0.06925	0.06725

All these gases, with the exception of hydrochloric acid, may be expelled from the water by long-continued boiling.

Gases are not absorbed by all liquids in the same order; for example, naphtha absorbs most olefiant gas, oil of lavender most protoxide of nitrogen, olive oil most carbonic acid, and solution of chloride of potassium most carbonic oxide.

If a mixture of two or more gases be agitated with water, or probably any other liquid, a portion of each gas will be absorbed, and the amount of each so absorbed or dissolved will be proportional to the relative volume of each gas multiplied with its coefficient of solubility at the observed temperature and pressure. As all ordinary liquids exert a greater or less solvent action on gases, a gas that we wish to examine quantitatively should be collected over mercury.

The adhesion of gases to solids next requires notice. Illustrations of this phenomenon perpetually occur. Thus, wood and other solid substances immersed in water or other liquids appear covered with air-bubbles. It is this adhesion of air to the surface of glass tubes which causes the difficulty of obtaining barometers and thermometers completely free from air. It is in consequence of the adhesion of air to their surfaces that many small insects are enabled to skim lightly over the surface of water which does not wet them. A simple method of illustrating this phenomenon is by gently dusting iron filings over the surface of a vessel of water; if we proceed carefully, a considerable mass of the iron may accumulate upon the surface; till, at last, it falls in large flakes, carrying down with it numerous bubbles of air. As the particles of iron are nearly eight times as heavy as water, it was only the adherent air that enabled them to float upon the surface. Closely allied to this adhesion is the remarkable property of condensation which porous bodies, and especially charcoal, exert on gases. Owing to this property of charcoal—especially freshly burned vegetable charcoal—various gases may be separated from their watery solution by filtration of the latter through it; for example, sulphureted hydrogen may be removed from water so completely that it cannot be detected either by its well-known odor or by the ordinary tests. Saussure found that 1 volume of freshly burned box-wood charcoal absorbed 90 volumes of ammonia, 85 of hydrochloric acid, 65 of sulphurous acid, 55 of sulphureted hydrogen, 40 of protoxide of nitrogen, 35 of carbonic acid, 35 of bicarbureted hydrogen, 9.4 of carbonic oxide, 9.2 of oxygen, 7.5 of nitrogen, 5.0 of carbureted hydrogen, and 1.7 of hydrogen. These results follow an order very nearly the same as that of the solubility of the gases in water.

Stenhouse has investigated the differences in the absorbent power of different kinds of charcoal; the following are his most important results: 0.5 of a gramme of each kind of charcoal being employed, and the numbers in the table indicating in cubic centimeters the quantity of absorbed gas.

Gas Used.	Kind of Charcoal employed.		
	Wood.	Peat.	Animal.
Ammonia	98.5	96.0	43.5
Hydrochloric acid	45.0	60.0	....
Sulphurous acid	32.5	27.5	17.5
Sulphureted hydrogen	30.0	28.5	9.0
Carbonic acid	14.0	10.0	5.0
Oxygen	0.8	0.6	0.5

So rapid is this action of charcoal, that Stenhouse has proposed to use a respirator filled with it to protect the mouth and nostrils in an infected atmosphere; and the employment of trays of powdered wood-charcoal in dissecting-rooms, in the wards of hospitals, and in situations where putrescent animal matter is present, is found to act very beneficially in purifying the air by absorbing the offensive gases. Its use in reference to the filtration of water has been already alluded to.

The determination of the exact specific gravity of the different gases is of great importance in calculating the proportions of the different ingredients of compounds into which they enter; and the whole series of numbers expressing the chemical equivalents or atomic weights of bodies depend upon the accuracy of the determination of the specific gravity of hydrogen and oxygen.

The following table gives the specific gravity and the weight of 100 cubic in. of some of the most important gases at a barometric pressure of 30 in., and at a temperature of 60°, together with the name of the observer:

Gas.	Specific Gravity. Air=1.	Weight of 100 Cubic Inches in Grains.	Observer.
Air	1.0000	30.935	Regnault.
Oxygen	1.1056	34.203	"
Nitrogen	0.9713	30.119	"
Hydrogen	0.0692	2.143	"
Carbonic acid	1.5290	47.303	"
Chlorine	2.5000	76.250	Thomson.
Ammonia	0.5902	18.003	"
Carbureted hydrogen	0.5555	16.944	"
Olefiant gas	0.9722	29.652	"
Arseniureted hydrogen	0.5290	16.130	Tromsdorff.
Sulphureted hydrogen	1.1805	36.007	Thomson.
Cyanogen	1.8055	55.069	Gay Lussac.
Hydrochloric acid	1.2847	39.183	Thomson.
Sulphurous acid	2.2222	67.777	"

The methods employed for determining the specific gravity of a gas, both by direct observation and by calculation, will be noticed in the article SPECIFIC GRAVITY.

As to the chemical properties of gases, most of the different gases, when pure, can be readily distinguished by some well-marked physical or chemical property. Some are distinguished by their color, others by their peculiar odor; but several of the most important ones—viz., oxygen, nitrogen, hydrogen, carbonic acid, carbonic oxide, light carbureted hydrogen, olefiant gas, and protoxide of nitrogen—require other means for their discrimination. The distinctive characters of the most important gases are noticed in the articles OXYGEN, HYDROGEN, CHLORINE, etc., and the outlines of the general method of analyzing a gaseous mixture are given in a separate article. For further details on the physical and chemical characters of the gases, we must refer to Miller's *Elements of Chemistry*, and especially to the volume on *Chemical Physics*, from which we have borrowed freely; to Kekule's *Lehrbuch der Organischen Chemie*, 1859; and to Roscoe's translation of Bunsen's *Gasometry*.

GASES, LIQUEFACTION OF. See LIQUEFACTION OF GASES.

GASKELL, Mrs. ELIZABETH C., an English author, was b. about the year 1820, and was the wife of a Unitarian clergyman in Manchester. Her maiden name was Stevenson. Her novels, of which *Mary Barton* (1848) and *Ruth* (1853) are perhaps the best examples, are chiefly descriptive of the habits, thoughts, privations, and struggles of the industrial poor, as these are to be found in such a social beehive as the city in which the author resided. Some of her characters are drawn with remarkable dramatic power, and many of her descriptive passages are very graphic. Among her other works may be mentioned *The Moorland Cottage* (1850), a Christmas story; *North and South* (1855); *Cranford;* and *Lizzie Leigh*—the last three of which originally appeared in *Household Words*. Mrs. Gaskell also edited a very interesting life of Charlotte Bronte (q.v.), 1857. Among her later works were *Sylvia's Lovers* and *Cousin Phyllis*. She died Nov., 1865.

GAS-LIGHTING IN RAILWAY TRAINS. Many methods have been tried within the last few years for lighing railway carriages with ordinary street gas; but with only partial success.

The more prevalent schemes are those in which the gas is contained in an elastic receptacle. Mr. Allen's plan, tried on some of the Scotch railways, is to place an india-rubber bag or box in the guard's compartment; it is protected by iron rods or bands, and weighted to press out the contents as the exhaustion goes on. The bag is filled with gas at the station from whence the train starts. A tube from the bag passes out by an opening from the van, and leads up to metal pipes that run along the roofs of the carriages. An india-rubber tube forms an elastic link from carriage to carriage; and small pipes bend down through the roof to supply burners in the interior of each carriage. The guard can regulate the supply, making the lights brighter or dimmer by easy apparatus under his control. The chief disadvantage of such plans as this is, that no carriages can be added to or deducted from the train without disturbing the arrangements, seeing that the tubing forms a connected system from end to end.

Mr. Dalziel's plan, tried on the South-eastern and the Great Northern lines, enables each carriage to maintain its light irrespective of the others in the train. There is a reservoir underneath the floor of the carriage, consisting of a boiler-like wrought-iron vessel, 9 or 10 ft. long by a foot and a half in diameter; it is invisible, and in no way incommodes the passengers. It is filled at the station, before the train starts, with gas enough to last all the burners in the carriage during a double through journey to some distant station and back again. Pipes lead up the ends of the carriage, and along the top to the spots where they bend down to supply the burners. The gradual exhaustion of the reservoir would produce a constantly decreasing pressure on the gas, and a consequent dimness of the light; but this is prevented by the use of an automatic compensating valve, which maintains the pressure equably. The gas, in the first instance, is forced into the reservoir at a pressure of 120 lbs. on the sq. inch.

The Metropolitan or underground railway, running for so great a part of its length through a dark tunnel, would be insupportably gloomy if the carriages were not well lighted. A system of gas-lighting is therefore adopted. Before the starting of each train, gas is conveyed from a gas-holder up through elastic tubes to the top of each carriage, where an oblong box extending from end to end receives enough of gas to last for two journeys. But of late, methods for condensing and storing up gas have been carried to such perfection as to allow of lighting floating buoys with condensed supplies of gas, enough being introduced at a time to keep up a flame for a period of several weeks.

GASOMETER. See GAS, LIGHTING BY.

GASPARIN, AGÉNOR ÉTIENNE, Compte de, 1810–71; a French statesman employed in the ministries of instruction and of the interior, and in 1842 elected to the chamber of deputies for Corsica. During the revolution of 1848 he was in the east, and refused to declare in favor of the new constitution. He was opposed to Louis Napoleon, and took up his residence in Switzerland, where he lectured upon economical, historical, and religious subjects. He is best known by his books, among which are *The Uprising of a Great People; or, The United States in* 1861, in which he took the northern view of our civil war; and *America before Europe*. He wrote also for the *Journal des Debats* and the *Revue des Deux Mondes*, and a number of volumes on slavery, Protestantism in France, Christianity and paganism, liberty and morals, a life of Innocent III., etc.

GASPÉ, the most easterly district of Lower Canada, consisting of the counties of Gaspé and Bonaventure, is chiefly a peninsula projecting into the gulf of St. Lawrence, between the estuary of the same name on the n. and the bay of Chaleur on the south. It stretches in n. lat. between 48° and 49° 20′, and in w. long. between 64° 15 and 67° 56′, containing 7,500 sq.m., and about 15,000 inhabitants, the greater number being of French descent. Cod and whale fishing forms the staple business of the country. *Gaspé Basin* is a prosperous and rising village on the bay of Gaspé, with a safe and splendid harbor. It was constituted a free port in 1860, and gives promise of becoming an important trading center. Pop. about 700.

GASPÉ, a co. in the district of Quebec, Canada, on the river and gulf of St. Lawrence and the bay of Gaspé, and including the Magdalen islands; 4,578 sq.m.; pop. '71, 18,729, of whom about two thirds were French. It has a rough surface, with fertile bottom lands. Lumbering and fishing are the employments. Chief town, Perce

GASSENDI, or **GASSEND**, PIERRE, an eminent French philosopher and mathematician, was b. Jan. 22, 1592, at Champtercier, a little village of Provence, in the department of the Lower Alps. His unusual powers of mind showed themselves at an early age; and in 1616 he became professor of theology at Aix. About this time, he drew upon himself the regards of Pieresc, whom Bayle calls the *procureur-general* of literature, and of Joseph Gautier, prior of La Valette, a distinguished mathematician, both of whom liberally gave him the benefit of their instructions and advice. With the first, he studied anatomy; from the second, he derived his taste for astronomical observations. After six years' study, he became disgusted with the scholastic philosophy, and undertook to maintain certain theses against the Aristotelians. His polemic appeared at Grenoble in 1624, and was entitled *Exercitationes paradoxicæ adversus Aristoteleos*. It was accompanied by an expression of his belief in the church, for whose honor and glory he declared himself "ready to shed the last drop of his blood." He drew a distinction for the first time between the church and the scholastic philosophy, denying that the former must stand or fall by the latter. Gassendi now visited Paris, where he made several influential friends. In the same year in which he published his *Exercitationes*, he was appointed *prevôt* of the cathedral at Digne, an office which enabled him to pursue without distraction his astronomical and philosophical studies. In 1628, he traveled in Holland, and got involved in a controversy with Robert Fludd, an English mystic, relative to the Mosaic cosmogony, in which he is admitted to have had greatly the advantage of his incoherent opponent. At the recommendation of the archbishop of Lyon, a brother of cardinal Richelieu, Gassendi was appointed professor of mathematics in the college royal de France, at Paris, where he died, Oct. 14, 1655. As a philosopher, Gassendi maintained, with great learning and ingenuity, most, though not all, of the doctrines of Epicurus, these being most easily brought into harmony with his own scientific acquirements and modes of thought. His philosophy was in such

repute, that the savants of that time were divided into Cartesians and Gassendists. The two chiefs themselves always entertained the highest respect for each other, and were at one time on the friendliest terms. The agreeableness of their intercourse, however, was for a while interrupted by the publication of a work of Gassendi's, entitled *Dubitationes ad Meditationes Cartesii*, in which he expressed himself dissatisfied with the tendencies of the new system of philosophy introduced by Descartes, for Gassendi was averse to novelty in the sphere of mental speculation, although he warmly espoused the side of progress in physical science, and made himself many enemies among his bigoted ecclesiastical brethren for the love he bore it. He ranked Kepler and Galileo among his friends, and was himself the instructor of Molière. His principal work is entitled *De Vita, Moribus, et Placitis Epicuri* (Lyons, 1649), to which the *Syntagma Philosophiæ Epicureæ* (1649) belongs. It contains a complete view of the system of Epicurus. His *Institutio Astronomica* (1645) is a clear and connected representation of the state of the science in his own day; in his *Tychonis Brahæi, Nicolai Copernici, Georgii Puerbachii, et Joannis Regiomontani Astronomorum Celebrium Vitæ* (Par. 1654), he not only gives a masterly account of the lives of these men, but likewise a complete history of astronomy down to his own time. Gassendi was pronounced by Bayle the greatest philosopher among scholars, and the greatest scholar among philosophers. His works were collected and published by Montmor and Sorbière (Lyons, 6 vols. 1658).

GASSNER, JOHANN JOSEPH, a man who made a noise as an exorcist in the 18th c., was born Aug. 28, 1727, at Bratz, near Pludenz, in the Tyrol, and became Catholic priest at Klösterle, in the diocese of Coire. While in that office, the accounts of demoniacs in the New Testament, combined with the writings of celebrated magicians, brought him to the conviction that most diseases are attributable to evil spirits, whose power can be destroyed only by conjuration and prayer. He began to carry out his conviction by practicing on some of his parishioners, and succeeded so far as to attract notice at least. The bishop of Constance called him to his residence, but having come very soon to the conviction that he was a charlatan, advised him to return to his parsonage. Gassner betook himself, however, to other prelates of the empire, some of whom believed that his cures were miraculous. In 1774, he even received a call from the bishop at Ratisbon, to Ellwangen, where, by the mere word of command, *Cesset* (Give over), he cured persons who pretended to be lame or blind, but especially those afflicted with convulsions and epilepsy, who were all supposed to be possessed by the devil. Although an official person kept a continued record of his cures, in which the most extraordinary things were testified, yet it was found only too soon that Gassner very often made persons in health play the part of those in sickness, and that his cures of real sufferers were successful only so long as their imagination remained heated by the persuasions of the conjuror. Intelligent men raised their voice against him, and he lost all respect before his death. He died, March, 1779, in possession of the wealthy deanery of Benndorf.

GAS-TAR, or COAL-TAR, a thick, black, opaque liquid, which comes over and condenses in the pipes when gas is distilled from coal. It is slightly heavier than water, and has a strong, disagreeable odor. Coal-tar is a mixture of many distinct liquid and solid substances, and the separation of the more useful of these constitutes an important branch of manufacturing chemistry. The tar is first distilled in large malleable iron stills, when *water* and *crude naphtha* first come over; and afterwards, when the temperature rises, a heavy, fetid-smelling oil, called *dead-oil*, which sinks in water. There remains in the still a large residue of *pitch*, which is again distilled in brick ovens, giving off an oil called *coke-oil*, and leaving a large quantity of *pitch-coke*. The crude naphtha is purified by sulphuric acid and quicklime, and re-distilled, when it is nearly as colorless as water. This, then forms the refined coal-tar naphtha of commerce. It is largely used for burning in lamps, as a solvent for india-rubber and gutta-percha, to preserve animal substances from moth, and it is also burned to produce a fine carbon for the manufacture of printing-ink. It is from the lighter portion of naphtha, called *benzole*, that the beautiful mauve and magenta colors are manufactured. See BENZOLE and DYE-STUFFS. Benzole is likewise used for removing stains of fat or oil from cloth. The dead-oil or pitch-oil is sometimes used, in its crude state, as a cheap material for affording light in lamps burned in the open air. It contains a considerable quantity of creosote, and forms the best preservative for wood in damp situations. The coke-oil is not of much commercial importance, but it can be burned in lamps, and this, with the dead-oil, when consumed in a confined atmosphere, gives a smoky flame, the soot from which constitutes lampblack. The pitch-coke is valuable as a fuel for melting iron, being free from impurities. Pitch itself is used for making asphalt pavement, and also for roofing-felt.

From the last portion of the distillation of the crude naphtha, and the first of the dead-oil, a beautiful white crystalline solid, called naphthaline, is obtained. It has been long known without being applied to any useful purpose, but is now beginning to be employed for the manufacture of colors, in a similar way to the benzole. The dead-oil also contains considerable quantities of a yellow solid termed paranaphthaline, which is a mere chemical curiosity.

The creosote is extracted from the dead-oil by stirring it with soda, in which the

creosote dissolves. When this soda solution is boiled for some hours, and then has an acid added to it, the creosote separates as an oil on the surface of the fluid, and, when distilled, is nearly pure. This treatment requires to be repeated several times to get it quite pure, and to keep its color. Most of the creosote used by druggists is made from coal-tar. The creosote from wood is a similar but quite distinct body.

Sulphuric acid extracts both from the dead-oil and the crude naphtha several volatile basic oils besides benzole—namely, toluole, xylole, cumole, and cymole, which are almost unknown in the arts, although they may yet come to be of great service. Among them is aniline, but not in sufficient quantity to pay for its extraction. There also occurs a curious body named pyrol, the vapor of which gives to fir-wood, dipped in muriatic acid, a splendid violet color. Beautiful blue colors have been made from these basic oils, but only by elaborate and expensive processes.

GASTEIN, a valley in the Austrian duchy of Salzburg, celebrated for its mineral springs. It is a side valley of the upper Salzach valley, and is about 25 m. long and 1½ m. broad. It has an elevation of between 3,000 and 3,500 feet. Behind it, to the south, tower the mountains of Malnitz or Nassfeld-Tauern, 7,820 ft. high, and the Ankogel, 10,700 ft. high, and from the right and left of these mountains two smaller ranges run northwards, forming its two side walls. The river Ache traverses the valley, and near Wildbad-Gastein forms two magnificent waterfalls, the upper, the Kesselfall, 200 ft., and the lower, the Barenfall, 280 ft. in height; and near these falls another called the Schleierfall, 250 ft. high, is formed by the stream which drains the Pockhart See. The principal villages are Bockstein, Hof-Gastein, and Wildbad-Gastein, and the population of the whole valley is about 3,800. Hof-Gastein, with a population of about 1000, possesses gold and silver mines which, in the 16th c., yielded 1180 lbs. of gold and 9,500 lbs. of silver annually. They are now, however, much neglected, and many of the old mines are covered by glaciers. The village contains a military hospital, and in the open platz there is a bust of the emperor Francis I., who, in 1828, caused a conduit of upwards of 5 m. long to be constructed for the purpose of conveying the mineral waters thither from Wildbad. Wildbad, the principal watering-place, is visited by upwards of 3,000 persons annually, and among its visitors is the present emperor of Germany. The thermal springs, which were known as early as the 7th c., issue from the granite mountains, and have a temperature of 117° Fahr. They are made use of in cases of nervous affections, general debility, and skin diseases; but the reason of their efficacy is somewhat mysterious, as chemical analysis discovers only a slight difference in the ingredients from those of ordinary spring water. The village is formed chiefly of wooden houses rising above one another in terraces; and there are several fine villas, one of which was constructed by the archduke John of Austria, and has a botanical garden.

GASTEIN, Convention of, concluded at Wildbad-Gastein, Aug., 1865, between Austria and Prussia, to regulate the relations of these two powers with respect to the duchies of Sleswick-Holstein and Lauenburg, which they had taken from Denmark, and occupied in common. They agreed that Sleswick should be placed entirely under Austrian administration, while Lauenburg should be annexed to Prussia, Austria ceding its part of it for 2,000,000 thalers.

GASTEROP'ODA (Gr. belly-footed), or Gastropods, a class of mollusks, inferior in organization to cephalopods, but far superior to almost all other mollusks, and containing a multitude of species, the greater number of which are marine, but some are inhabitants of fresh water, and some are terrestrial. Snails, whelks, periwinkles, limpets, cowries, and the greater number of mollusks with univalve shells belong to this class, and univalve molluscs constitute the greater part of it; but it contains also some mollusks with multivalve shells, as chitons, and some, as slugs, which have either only a rudimental internal shell, or no shell at all. Some aquatic kinds are destitute of shell in the adult state, but they are protected by a rudimentary shell on first issuing from the egg. No known gastropod has a bivalve shell, unless the *operculum*, which closed the mouth of the shell in many species, be regarded as a second valve.

Gastropods have a head, more or less fully developed, in which is situated the mouth, and which generally carries fleshy, retractile tentacula, varying from two to six in number. The tentacula do not encircle the mouth; they seem to be special and exquisitely sensitive organs of touch, a sense which the general surface of the body does not seem to possess in a high degree; and in some gasteropoda, as snails, they carry the eyes at their tips, but in others the eyes—always small—are situated elsewhere on the head, and a few are destitute of eyes. They are believed to possess the senses of taste and smell, and at least some of them that also of hearing, as they not only have a nervous center analogous to the acoustic division of the brain in vertebrate animals, but a little sac on each side, apparently an organ of this sense. Their nervous system is more complex and concentrated than that of the headless (*acephalous*) mollusks; the principal nervous masses surround the gullet. In the highest gasteropoda, such as snails, there are only two principal nervous masses, one of which, supplying the nerves connected with sensation, is called the brain. The blood of gasteropoda is often opalescent, with a few colorless corpuscles. The heart is always *systemic* only, and in almost all consists of one auricle and one ventricle, although a few gasteropoda have

two auricles, one for each set of gills. Near the commencement of the aorta, there is often a contractile muscular swelling (*bulbus arteriosus*), as in fishes. Respiration takes place generally by gills, which are very variously situated, sometimes externally, sometimes in a special cavity, and exhibit an equally great variety of form and structure: but some gasteropoda, as snails and slugs, have, instead of gills, a pulmonary sac or cavity, lined with a vascular net-work, these being either inhabitants of the land, or, if of the water, obliged to come occasionally to the surface for the purpose of breathing. A few of the lowest gasteropoda, doubtfully placed in this class, are destitute of distinct respiratory organs. The digestive apparatus also exhibits much diversity. Some of the gasteropoda feed on vegetable, some on animal substances, and some of them on animals which they themselves kill. Thus, whilst snails eat leaves and other soft parts of vegetables, whelks (*buccinum*) prey on other mollusks, and are provided with a remarkable apparatus at the end of a proboscis into which the mouth is elongated, for filing a hole—as nice as could be made by the drill of a mechanic—through the hardest shell. The mouth of the snail is, in like manner, admirably adapted to the cutting of leaves or similar substances by the action of the lips against a sharp horny plate. Other gasteropoda have the mouth furnished with two cutting blades, wrought by powerful muscles. The tongue of some is covered with minute recurved hooks, to prevent the possibility of anything escaping from the mouth; and the stomach of some is a muscular gizzard, provided with cartilaginous or sometimes calcareous projections, or stomachic teeth, to aid in the comminution of the food. The intestine is generally bent back, so that the anus is not far from the head. The liver is large, as are also the salivary glands of many gastropods. Very great diversities are found in the reproductive system. In some gasteropoda, the sexes are distinct (G. DIŒCIA); others are hermaphrodite (G. MONŒCIA); and whilst self-impregnation takes place in some of these, others—as snails—mutually impregnate each other by copulation. In general, the reproductive organs are very largely developed, and are of complex and remarkable structure. The gasteropoda are in general oviparous; a few are ovoviviparous. The young of aquatic gasteropoda at first swim about actively by means of ciliated fins attached to the head. Gasteropoda are generally unsymmetrical, one side of the body being developed without the other, some of the principal organs of which—the gills and nerves—are atrophied; and thus the shell with which most of them are covered becomes, in the greater number, spiral, the spire turning towards the unatrophied side, which is generally the right side, although in some (*reversed* or *sinistrorsal* shells) it is the left. The head and the organ of locomotion are capable of being withdrawn into the last whorl of the shell, and in aquatic species generally, the mouth of the shell can be closed by an *operculum* (q.v.), exactly fitting it, and attached to the *foot*, but in which many varieties of beautiful structure are exhibited, and which is generally horny, sometimes calcareous. Some shells are simply conical, and there are numerous diversities of form. The shell is secreted by the *mantle*. See MOLLUSKS, SHELLS, and UNIVALVES. The viscera are contained in a thin sac—part of the mantle—which fills the upper part of the shell. The organ of locomotion, called the *foot*, is in general a muscular disk, developed from the ventral surface of the body; sometimes, as in limpets, capable of acting as a sucker, and exhibiting other even more remarkable modifications, so that in some it becomes an organ for swimming. Gasteropoda generally creep by means of this disk adhering to surfaces, and contracting in traverse wrinkles or undulations, which begin from behind. The gasteropoda generally secrete a peculiar kind of slime. Some of them also produce other peculiar secretions, of which the Tyrian purple affords an example. Gasteropoda have a great power of renewing lost parts; tentacles are thus restored, and even the eyes which they bear at their tips, the mouth with all its apparatus, or the head itself.

GASTON, a co. in s.w. North Carolina, on the Catawba river; intersected by the Carolina Central and the Atlanta and Richmond Air-line railroads; 330 sq.m.; pop. '70, 12,606—4,172 colored. The surface is varied and the soil fertile, producing wheat, corn, oats, cotton, etc. Some gold is found. Co. seat, Dallas.

GASTON, WILLIAM, LL.D., 1778–1844; b. N. C.; graduated at Princeton, and admitted to the bar in 1798. He served in the state legislature, and in 1818 was elected to congress, where he was one of the leaders of the federalists. In 1835, he was a member of the state constitutional convention, where he advocated the right of free negroes to the suffrage which they then possessed but which the new constitution finally took from them. In 1834, he was appointed a judge of the supreme court and held the office until his death.

GASTON DE FOIX. See FOIX.

GASTRALGIA, or GASTRODY'NIA. See CARDIALGIA.

GASTRIC JUICE. See DIGESTION, ORGANS AND PROCESS OF.

GASTRITIS AND GASTRO-ENTERITIS (inflammation of the stomach, etc.). See STOMACH, DISEASES OF, also ENTERITIS.

GASTROCHÆ'NA, a genus of lamellibranchiate mollusks, having a delicate shell of two equal valves, gaping very much in front; the animal sometimes taking possession of an already existing cavity, which it often lines with a calcareous lining, so as to form a tube, to which the valves of its shell are cemented; sometimes burrowing for

itself in sand, madrepores, or calcareous rocks, and lining its hole with a shelly layer. *G. modiolina*, a rare British mollusk, common in the Mediterranean, perforates shells and limestone, making holes about 2 in. deep and half an inch in diameter. It sometimes bores right through an oyster into the ground below, and makes for itself a flask-shaped case, with its neck fixed in the oyster-shell. The tubes of some of the tropical species which live in sand are very curious.—To the family *gastrochænidæ* are referred *aspergillum* and *clavagella*.

GASTROCNE'MIUS MUSCLE, THE, is the muscle forming the greater part of the calf of the leg. It arises by two heads from the two condyles of the thigh-bone, and is inserted by the TENDO ACHILLIS at the posterior part of the heel-bone. In man, these muscles possess great power, and are constantly called in use in standing, walking, leaping, etc. In walking, they raise the heel, and, with it, the entire body from the ground; and the body being thus supported on the raised foot, the other leg is carried forward. From their close association with the erect position, they are much less developed in other mammals than in the human subject.

GASTRO'DIA, a genus of orchids. *G. sesamoides* is a native of Van Diemen's Land, the roots of which form large coral-like masses, and are sometimes called *native potatoes*, being edible; but they are watery and insipid.

GASTROS'TOMY (Gr. *gaster*, the belly or stomach, and *stoma*, mouth), an operation which has been two or three times performed for the relief of stricture of the gullet, to relieve the patient from the imminent risk of starvation, by introducing food directly into the stomach through an external opening. The well-known case of Alexis St. Martin, and numerous experiments on the lower animals, have led to this attempt, not unreasonably, to save life; it has not as yet, however, been successful.

GASTROT'OMY (Gr. *gaster* and *tomē*, an incision), an incision into the cavity of the abdomen (q.v.) for the purpose of removing some diseased texture or foreign body. The term has also been applied to Cæsarean section (q.v.).

GATAKER, THOMAS, 1574–1654; b. London; author of a number of works on Scripture subjects. He was one of the assembly of divines at Westminster, and was one of the warmest opposers of the parliament's proceedings against Charles in 1648.

GATE OF ITALY, that portion of the valley of the Adige in the vicinity of Trent and Rovedero; a narrow gorge between two mountain ridges.

GATES, a co. in n.e. North Carolina, on the Virginia border and the Chowan river; 353 sq.m.; pop. '70, 7,724—3,207 colored. Surface mainly level and covered to a large extent with oak and pine. The n.e. part is occupied by the Dismal Swamp. Productions, corn, cotton, tar, and lumber. Co. seat, Gatesville.

GATES, HORATIO, a gen. of the U. S. army, was b. in England in 1728. He early entered upon a military career, and first bore arms under prince Ferdinant of Brunswick. Sent to America in 1755, as capt. of infantry, he served under gen. Braddock, and with difficulty escaped in the defeat in which that officer was slain. On the peace of 1763, he purchased an estate in Virginia, where he resided until the war of independence. In this struggle, he sided with his adoptive, against his native, country, and in 1775 was made adj.gen. with the rank of brig. in the colonial army. He accompanied Washington to Massachusetts in July of the same year, where he remained till June, 1776, when he received the chief command of the army which had just retreated from Canada. In Mar., 1777, he superseded Schuyler in command of the army of the north, but being considered too prudent, was himself superseded by Schuyler in the following May. In Aug., however, he once more undertook the command, and soon compelled the entire British army (consisting, as some say, of 5,700 men, or as others, of 3,500) to surrender at Saratoga. This brilliant success gained for him a great military reputation, and his considerate conduct towards his compatriots won him the esteem of even his enemies. In 1780, Gates was called by congress to the command of the army of the south, and in the unfortunate defeat of Camden lost the laurels he had already won. He was superseded, and was not acquitted of blame by court-martial till 1782, after a protracted trial. He then retired to Virginia till 1790, when he emancipated all his slaves, and settled in New York. He died on April 10, 1806.

GATES'HEAD, a t. of England, in the co. of Durham, and an ancient borough under the Episcopal palatines of that co. was formerly governed by a bailiff and burgesses, and became a parliamentary and municipal borough under the reform act of 1832, and the municipal corporations reform act of 1835. It is situated on the s. bank of the Tyne, directly opposite Newcastle, to which it is joined by two bridges, and with which it is otherwise so closely connected as virtually to form one town with it. The older portions of the town are poorly built, but great extensions have been made westward and southward, in which directions much ground has been laid out in new streets and detached villas. There are numerous dissenting as well as established churches, a grammar school founded in 1700, a mechanics' institute, and an hospital (King James's), consisting of the master (who is the rector of Gateshead for the time being) and three brethren who have residences, and 12 others who receive allowances without residence. It has also an excellent dispensary, which was established after a

dreadful visitation of cholera in 1831–32, which carried off 1028 of the population. The numerous coal-mines in the neighborhood, iron-works and foundries, glass-works, brick, tile, and soap-works, ship-building, chemical-works, etc., furnish employment to the inhabitants. There are also extensive manufactures of anchors, machinery, chain-cables, iron-wire and other ropes. At Gateshead Fell are quarries from which the famous grindstones erroneously called, but proverbially known as "Newcastle grindstones" are obtained, and exported to all parts of the world. In Oct., 1854, a large portion of the lower part of Gateshead, as well as considerable property in Newcastle immediately opposite, was destroyed by an awful explosion and fire, which also caused the death of upwards of 50 persons. Gateshead sends one member to the house of commons. The pop. in 1871 was 48,627. Gateshead is supposed to have been at one time a Roman station, or outwork to the Roman station at Newcastle, several coins and other relics having been found from time to time. The derivation of the name has long been matter of dispute, but the probability is, that it simply means the head of the *gate* or road with which the Romans connected Newcastle with the southern military divisions and defenses.

GATE OF TEARS, in the strait of Bab-el-Mandeb, forming the passage from the Red sea into the Indian ocean. It received this name from the early Arabs on account of its dangerous navigation and the number of wrecks that occurred.

GATEWAY. the passage or opening in which a gate or large door is hung. This may be either an open way with side pillars or a covered way vaulted or roofed over. The gateway being a most important point in all fortified places, is usually protected by various devices. It is flanked by towers with loopholes, from which assailants may be attacked, and is frequently overhung by a machicolated battlement, from which missiles of every description were poured upon the besiegers. City gates, and gates of large castles, have in all ages been the subjects of great care in construction; and when from some cause, such as the cessation of constant fighting, or a change in the mode of warfare, gateways have lost their importance in a military point of view, they have maintained their position as important architectural works, and where no longer useful, have become ornamental. In very ancient times, we read of the "gate" as the most prominent part of a city, where proclamations were made, and where the kings administered justice. The Greek and Roman gates were frequently of great magnificence. The propylæa at Athens is a beautiful example, and the triumphal arches of the Romans are the ornamental offspring of their city gates. Most of the towns in this country have lost their walls and city gates; but a few, such as York and Chester, still retain them, and give us an idea of the buildings which formerly existed, but which now remain only in the name of the streets where they once stood. Our castles retain more of their ancient gateways, and from these we may imagine the frowning aspect every town presented during the middle ages. Abbeys, colleges, and every class of buildings were shut in and defended by similar barriers; many of these still exist in Oxford and Cambridge, and the abbey gates of Canterbury and Bury St. Edmund's are well-known specimens of monastic gateways. The feeling of personal freedom, which is so strong in this country, must no doubt have tended greatly to hasten the demolition of these marks of feudalism; but on the continent, where every man has to present a passport at the gate of the city before entering it, we still find these barriers kept up.

GATH (in Heb. a "wine-press"), one of the five chief cities of the Philistines, was situated on the frontiers of Judah, and was in consequence a place of much importance in the wars between the Philistines and the Israelites. It formed, in fact, the key of both countries, and was strongly fortified. The famous Goliath, whose gigantic height and swaggering air so frightened the troops of king Saul, and who was slain by the stripling David with pebbles from the brook, was a native of this place. Jerome describes it in his time as a "very large village." The site of ancient Gath is probably the little eminence, about 200 ft. high, now known as Tell-es-Sâfret, at the foot of what were once called the mountains of Judah.

GATINEAU, a large river of North America in Canada East, has its origin in a connected chain of large lakes lying immediately n. of the 48th parallel of latitude. It flows in an almost undeviating course s.s.w., and falls into the Ottawa, in lat. 45° 24′ n., long. 75° 43′ w., 12 m. below the town of Aylmer. The length of this river has not been definitely ascertained, but it is said that canoes have navigated it for upwards of 300 miles. Steamers have ascended it for 4 miles.

GATLING, Richard Jordan, b. N. C., 1818; a mechanic and inventor. While yet a boy he aided his father in making machines for sowing cotton seed, and one for thinning out the plants. He patented a machine for rice sowing, adapting it also to sowing grain in drills. Among his other inventions were a hemp-break, and a steam plow. He is best known as the inventor of the revolving battery which bears his name. (See Gatling Gun.)

GATLING GUN, a machine-gun of the mitrailleuse order, invented by Dr. R. J. Gatling of Indiana, in 1861. It has generally 5 or 10 barrels, and each barrel has a corresponding lock. Although the barrels and locks revolve together, the locks have a forward and backward action. By means of the forward motion the cartridges are placed

in the chambers of the barrels and the breech is closed when the discharge occurs; while through the agency of the backward motion the empty cartridge cases are extracted. The Gatling gun is fed by feed-cases which are made to fit in a hopper communicating with the chambers. Continuous firing can be carried on at the rate of 1000 shots a minute, as one case is replaced by another as fast as it is emptied. The five-barrel gun weighs 100 lbs., is mounted on a tripod, and can be fired at the rate of 800 shots a minute. The bore of each barrel extends through from end to end, and the breech is chambered to receive a flanged "center-fire" metallic-case cartridge of the kind that are in use for the Springfield rifle and similar arms. The breech ends of all the barrels are screwed into a disk called the rear barrel-plate, which is fastened to the central shaft; the muzzles pass through another disk called the front barrel-plate, on the same shaft. A hollow metal cylinder is fastened upon an extension of the central shaft, and is called the carrier-block, behind which the shaft carries another cylinder because each lock is acted on by a spiral spring acting on a hammer by which the charge is fired. The shaft, the group of barrels, the carrier-block, and the lock-cylinder, being all connected, revolve together; this revolution is effected by a toothed wheel which is fastened to the shaft and is worked by an endless screw on a small axle placed at right angles to the shaft and furnished outside with a hand crank. When the lock-cylinder revolves it carries the locks around with it, and gives them a longitudinal reciprocal motion by their rear ends sliding along a groove in the inclined surface of the stationary spiral cam, so that the several locks in succession are forwarded towards their respective barrels. The Gatling gun is elevated and lowered like an ordinary field gun, but it has the disadvantage as compared with shell guns of not being able to deliver a curved fire. It is constructed with calibers of 1-in., weight 650 lbs.; .75-in. and .65-in., each weighing 450 lbs.; .55-in., weight 400 lbs.; and .50-in., .45-in., and .42-in., each weighing 200 lbs.

GATSCHINA, a t. of Russia, in the government of Petersburg, and about 30 m. s.s.w. of the city of that name, is charmingly situated on a small lake formed by the Ishora. It is regularly built, has an educational institution for foundlings, a horticultural school, and some manufactures of porcelain; but is especially worthy of mention for its royal palace, a structure at once simple in its style and imposing in its effect. This palace, which contains 600 apartments, and is surrounded by one of the finest pleasure gardens in Europe, was the favorite seat of the emperor Paul I., who bestowed municipal rights upon the town of Gatschina in 1797. The pop. of Gatschina in 1867 was 8,337.

GAU (of doubtful origin, possibly allied to Gr. *ge*, land), a German word meaning, in a general way, country (as opposed to the town), district; but applied specially to a political division of ancient Germany, having relation to the arrangements for war and the administration of justice. A gau embraced several communities or villages, and had one or more grafs (q.v.) and judges over it. As the grafdoms become more and more hereditary, the gau, as a political division, fell into disuse (about the 12th c.), and only in the names of some places do the traces of it remain. The abbot Bessel gave a complete account of the geography of the German gaus in his *Chronicon Gottwicense;* and Spruner's *Historical Atlas* contains a map of them. The nature of the gau system is fully discussed in the works of Eichhorn, Waitz, and Bethmann-Hollweg. See HUNDRED.

GAUBIL, ANTOINE, 1689–1759; a Roman Catholic missionary, b. at Gaillac, in Languedoc. He joined the Jesuits in his 15th year, and in his 34th was sent by them to China. When he arrived there the emperor, Young-Tsching, who had just commenced his reign, was determined to banish the Jesuits. Through Gaubil's address nearly all of them remained undisturbed. In 1736, when Kiang-Loung became emperor, Gaubil, who had acquired an accurate knowledge of the Chinese and Mantchou languages, was appointed chief director of the royal colleges in which the children of the nobility were educated. This office gave him a high standing at the imperial court, which he retained until his death. He was the author of a large number of books on Chinese history, literature, and science.

GAUCHOS. See GUACHOS, *ante*.

GAUDEN, JOHN, 1605–62; the reputed author of *Eikon Basilike*, was b. in Essex, of which parish his father was vicar. He was educated at Bury St. Edmund's, and afterwards at St. John's college, Cambridge. He obtained about 1630 the vicarage of Chippenham, in Cambridgeshire, and the rectory of Brightwell in Berkshire. At the breaking out of the civil war, he was domestic chaplain to Robert Rich, second earl of Warwick, one of the parliamentary leaders, and, being selected to preach before the house of commons in 1640, was presented with a silver tankard in acknowledgment of his discourse. In 1641, he was appointed by the parliament to the deanery of Bocking, in Essex. He became master of the Temple in 1659, as successor to Dr. Ralph Brownrigg, bishop of Exeter, and after the restoration in Nov., 1660, he was appointed to the same diocese. Between 1642, the date of his first published work, and 1660, he published some thirteen or more books, of which number, however, only one appeared prior to the execution of the king. Soon after his appointment to the see of Exeter, he privately laid claim to the authorship of the *Eikon Basilike*, a work commonly attrib-

uted at that time to Charles I. This claim Gauden put forth in a correspondence with the lord chancellor Hyde, earl of Clarendon, and the earl of Bristol, from Dec. 21, 1660, to Mar. 31, 1662. The whole question of the claims of Charles I. and Dr. Gauden was discussed at great length, and with considerable ability and ingenuity, from 1824 to 1829 by Dr. Christopher Wordsworth, master of Trinity college, Cambridge, on behalf of the king, and the Rev. H. J. Todd on the side of Dr. Gauden. Fresh evidence, however, has lately turned up in the shape of letters and papers of Charles II. and his ministers, written soon after the execution of the king, which go far to invalidate if not entirely destroy the claim of Dr. Gauden, and to prove that those persons to whom he most confidently appealed in support of his pretensions were the strongest upholders of the king's authorship at the time immediately subsequent to the appearance of the work. Within the last six months (Oct., 1880), Mr. Scott of the British museum has published a book containing the latest documents and authorities upon the subject of the *Eikon Basilike*, of which a limited number of copies only has been issued. In 1662, on the death of Brian Duppa, bishop of Winchester, Dr. Gauden applied to be translated from Exeter to that see, but his claims were set aside in favor of George Morley, bishop of Worcester, and the vacancy thus created was filled by the bishop of Exeter. He lived only four months after this last promotion. [In part from *Encyc. Brit.*, 9th ed.]

GAUERMANN, Friedrich, 1807–62; an Austrian painter, son of the landscape painter Jacob Gauermann. Under his father's direction he began studies in landscape, and he also diligently copied the works of the chief masters in animal painting which were contained in the academy and court libraries of Vienna. In the summer he made art tours in the districts of Styria, Tyrol, and Salzburg. Two animal pieces which he exhibited at the Vienna exhibitions of 1824 were regarded as remarkable productions for his years, and led to his receiving commissions in 1825 and 1826 from prince Metternich and Caraman, the French ambassador. His reputation was greatly increased by his picture "The Storm," exhibited in 1829, and from that time his works were much sought after, and obtained correspondingly high prices. His "Field Laborer" was regarded by many as the most noteworthy picture in the Vienna exhibition of 1834, and his numerous animal pieces have entitled him to a place in the first rank of painters of that class of subjects. The peculiarity of his pictures is the representation of human and animal figures in connection with appropriate landscape and in characteristic situations so as to manifest nature as a living whole, and he particularly excels in depicting the free life of animals in wild mountain scenery. Along with great mastery of the technicalities of his art, his works exhibit patient and keen observation, free and correct handling of details, and bold and clear coloring. Many of his pictures have been engraved, and after his death a selection of fifty-three of his works was prepared for this purpose by the Austrian Kunstverein (Art Union).

GAUGE, an apparatus for measuring any special force or dimension; thus we have *pressure-gauge*, *wind-gauge* (see Anemometer), *rain-gauge* (q.v.), *wire-gauge*, *button-gauge*, etc. The simplest form of gauge of dimension is the common *wire-gauge*, by which the diameter of wire is measured. It is simply an oblong plate of steel, with notches of different widths cut upon the edge; these are numbered, and the size of the wire is determined by trying it in the different notches until the one is found which it exactly fits. The thickness of sheet-metal is tried by the same gauge. There is a great want of uniformity in these gauges—the Birmingham gauge for iron-wire, sheet-iron, and steel differing from that used for brass, silver, gold, etc.; and these again from the Lancashire gauges. It has been proposed, in order to obtain uniformity, and to enable definite descriptions and orders to be given with accuracy and certainty, that instead of the arbitrary numbers of varying signification now in use, decimal parts of an inch, tenths, hundredths, thousandths, or still smaller fractions, if necessary, be used, and that these be used for all diameters and thicknesses, such as wires, sheet-metals, buttons, watch-glasses, etc.; but such a scale has not yet come into general use. The gauge commonly used for buttons, watch-glasses, and such like large diameters, is a rule with a groove cut lengthwise down the middle. Another metal rule, with a brass head, slides in this, and by means of a thumb-pin, may be pushed out at pleasure. The object to be measured is placed between the inside of the slide and the end of the rule, and the width of this space is measured by graduations on the middle metal slide.

A very elegant and delicate gauge has recently come into use for measuring watch-glasses, and is applicable to many other purposes. On an oblong piece of sheet-metal. two straight metal ridges are fixed in such a manner that they shall be inclined at a given angle to each other. Now, let us suppose the angle to be such that the distance between the upper extremities is 2 in., and that between the lower ends is 1 in., while the lengths of the metal ridges are 10 inches. It is evident that for every inch of descent from the upper to toward the lower ends, there will be a narrowing equal to $\frac{1}{10}$ of an inch; and for every tenth of an inch of such descent, there will be a narrowing of $\frac{1}{100}$ of an inch, and so on: thus we may, by graduating downwards from the top, measure tenths by units, hundredths by tenths, and so on to still finer quantities if required. This is applicable to lengths as well as diameters. By means of fine screws with large

graduated heads, Messrs. Whitworth have measured small pieces of steel to the one-millionth of an inch (see MICROMETER). Pressure-gauges, wind-gauges, etc., will be treated under the special subjects.—In railways, the gauge means the distance between the rails. See RAILWAY.

GAUGER, an officer of excise, whose duty it is to gauge or measure casks containing excisable liquors or other commodities. Such persons are precluded from dealing in excisable commodities under the penalty of forfeiture of office, and incapacity to fill any other in connection with the excise; and the crime of accepting a bribe is punishable with the penalty of £500, and incapacity for any government office.

GAUGING. When this term is used without qualification, it refers specially to the gauging of the contents of casks; and in many places, the popular name for the excise officer who measures the contents of casks containing excisable liquors is "gauger." Sliding scales, which are graduated according to the mathematical rules for determining the solid contents of regular solids approximating to the form of the casks, are used, but considerable practice and skill are required to apply them with accuracy.

GAUL. See FRANCE.

GAULAY MOUNTAINS, a portion of the ridge in West Virginia known as the Cumberland mountains. This term is sometimes specifically applied to the Little Gaulay mountains in Nicholas county. They afford some grand scenery.

GAULT, a member of the cretaceous formation (q.v.), separating the lower from the upper greensand. It consists of an upper part, hard and sandy, and containing green particles scattered through it; and of a lower portion, a stiff dark gray, blue, or brown clay, smooth and uniform in texture, and very plastic, which is manufactured into tiles, bricks, and even common pottery. Concretions of iron pyrites and other nodules are not uncommon in the gault. The contained fossils are for the most part beautifully preserved, having been protected from decay by being buried in the tenacious and compact mud which forms the gault beds. The most abundant remains are those of cephalopodous mollusks, as ammonites, scaphites, and turrilites.

The gault occurs at Folkstone, and stretches w. through Kent and Surrey into Hampshire, and then, turning eastward through Sussex, it is seen on the coast near Beechy Head. It also stretches in a narrow line from Dorsetshire, in a north-easterly direction, through the center of England, till it reaches the coast at Hinstanton, in Norfolk. Its maximum thickness is 150 feet. In Surrey, the gault supplies considerable quantities of phosphatic nodules, largely used by agriculturists for fertilizing soils.

The Blackdown beds in Dorsetshire are probably contemporaneous with the gault, the one having been deposited near the shore, while the fine mud of the gault was carried out to sea. The Blackdown beds, however, contain greensand fossils mixed with those of the gault, so that the exact age of the deposit is still doubtful.

GAULTHE'RIA, a genus of small procumbent or nearly procumbent evergreen shrubs, of the natural order *ericeæ*, the fruit of which is a 5-valved capsule, covered with the enlarged and fleshy tube of the calyx. They are natives of temperate regions. *Gaultheria procumbens* is a common plant in North America as far s. as Virginia, and bears the names of PARTRIDGE BERRY, DEER BERRY, WINTERGREEN, and MOUNTAIN TEA. It is about 4 or 5 in. in height, with small whitish flowers and red "berries," which are eatable, but not safe in any considerable quantity, because of the pungent volatile oil which they contain. Brandy in which they have been steeped is used as a tonic. The whole plant has an agreeable aromatic odor and taste, owing to the presence of volatile oil, which, when extracted, is used in medicine as a stimulant, also by druggists for flavoring syrups, and to a considerable extent in perfumery, under the name of *oil of winter green*. The leaves are used both as an astringent and as a stimulant; and an infusion of them is used as tea in America, for which purpose those of another species are also employed in Nepaul.—The SHALLON (*gaultheria shallon*) is a comparatively large species, 2 or 3 ft. high, with purple berries, which are agreeable to the palate, and form a considerable part of the food of Indians in the n.w. of America, of which the plant is a native. It grows well under the shade of woods, and has of late been planted in many places in Britain, to afford food for pheasants and other kinds of game.—*Gaultheria hispida* is a native of Van Diemen's Land, bearing snow-white berries, and known by the name of WAX-CLUSTER. The berries are eaten.—Other species, some of which are fragrant, some produce edible berries, and all are beautiful little shrubs, are found in the Himalaya mountains, the mountains of South America, Australia, etc. The Australian *gaultheria antipoda* is said to be a finer fruit than *gaultheria hispida*.

GAUNTLET. See GANTLET.

GAUR, or GOUR (*Bos Gaurus*), a species of ox, inhabiting some of the mountain jungles of India. It is of very large size, although apparently inferior to the arnee (q.v.). It bears a considerable resemblance to the gayal (q.v.), but differs from it in the form of its head, and in the total want of a dewlap, in which it more nearly agrees with the banteng of the Eastern archipelago, although distinguished from it by important anatomical peculiarities. See BANTENG. The back is strongly arched, having a

remarkable ridge of no great thickness, which rises above its general line, owing to an unusual elongation of the spinous processes of the vertebræ. The hair is remarkably short and sleek. The gaur is formidable even to the tiger, and safe from his attacks. It is usually found in herds of from ten to twenty. It is extremely abundant in the high insulated tableland of Myn Pat, in South Bahar, and in the adjoining steep and narrow valleys. It is supposed to be incapable of domestication; frequent attempts for this purpose are said to have been made in Nepaul,

GAUR, or GOUR, a mediæval city in Bengal. The name signifies "country of sugar." We have the names of dynasties, and partial lists of the kings, which bore the title of lord of Gaur, or Guada, before the first Mohammedan invasion. The last of these dynasties, that of the Senas, or of the Vaidyas, superseded its predecessor, the dynasty of the Palas, about the middle of the 11th century. The most eminent of this dynasty, by name Lakshmanasena, who flourished at the end of the century, is alleged in inscriptions to have extended his conquests to Kanauj (in the Doab), to Nepaul, and to the shores of Orissa; this king is said by tradition to have founded the royal city in Guada which in later days reverted to a form of this ancient name (Gaur), but which the founder called after his own name, Lakshmanavati, or as it sounded in the popular speech, Lakhnaoti. The fifth from this king, according to Lassen's list, Lakshmaniya (c. 1160-98), transferred the royal residence to Navadvipa, Nadiya (on the Hoogly river, 70 m. above Calcutta), possibly from apprehension of the rising tide of the Mohammedan power; but here it overtook him. Nadiya was taken about 1198-99 by Mohammed Bakhtiyar Khilji, the general of the slave king Kutbuddin Aibak of Delhi, who became established as governor of Bengal, and fixed his capital at Lakhnaoti. Here he and his captains are said to have founded mosques, colleges, monasteries. Lakhnaoti continued for the most part to be the seat of rulers who governed Bengal and Behar, sometimes as confessed delegates of the Delhi sovereigns, sometimes as practically independent kings, during the next 140 years. From the year 1338, with the waning power of the Delhi dynasties, the kingdom of Bengal acquired a substantive independence which it retained for more than two centuries. One of the earliest of the kings during this period, by name Ilyas (Elias) Shah, whose descendants reigned in Bengal with brief interruptions for nearly 150 years, transferred the seat of government to Pandua (c. 1350), a place about 16 m. n. by e. of Gaur, and to the neighboring fortress of Elkdala, a place often named in Mohammedan notices of the history of Bengal down to the 16th century. At Pandua several kings in succession built mosques and shrines, which still exhibit architecture of an importance unusual in Bengal proper. After some occasional oscillation the residence was again (c. 1446) transferred to Gaur, by which name the city is generally known thenceforward, that of Lakhnaoti disappearing from history. The 24th and last of those whom history recognizes as independent kings of Bengal was Mahmud Shah (1533-34 to 1538-39). In his time the city more than once changed hands, during the struggle between the Afghan Sher Shah and the (so-called) "Great Moghul," Humayun, son of Baber; and on one occasion (1537-38), when Sher Shah was operating against Gaur, we first hear of the Portuguese in the inner waters of Bengal. A party of that nation who had been sent with presents to the court of Gaur had been detained as prisoners by the suspicious Mahmud. But in the straits arising during his resistance to Sher Shah, the Frank prisoners were able to render him good service. Mahmud was followed by several Pathan adventurers, who temporarily held the provinces of the delta with more or less assertion of royal authority. One of these, Suleiman Kirani (1564-65), abandoned Gaur for Tanda, a place somewhat nearer the Ganges. It is mentioned by Ralph Fitch, the earliest of European travelers in India, who calls it "Tanda in the land of Gouren," standing a league from the Ganges. Mu'uim Kahn, Khankhanan, a general of Akbar's when reducing these provinces in 1575, was attracted by the old site, and resolved to readopt it as the seat of local government. But a great pestilence (probably cholera) broke out at Gaur, and swept away thousands, the general-in-chief being himself among the victims. On his death the deprived Pathan prince, Daud, set up his standard again. But he was defeated by the forces of Akbar in a battle at Rajmahl, and taken prisoner. After him no other assumed the style of king of Bengal. Tanda continued for a short time to be the residence of the governors under the "Great Moghuls," but this was transferred successively to Rajmahl and Dacca, in repeated alternation, and finally to Moorshedabad. Gaur cannot have been entirely deserted, for the Nawab Shuja-uddin, who governed Bengal 1725-39, built a new gate to the citadel. But in history Gaur is no longer heard of, till its extensive remains attracted the curiosity of the English,—the more readily as the northern end of the site approaches within 4 m. of the important factory that was known as English Bazar (among the natives as Angrezábad), which is said to have been built of bricks from the ruins, and which is now the nucleus of the civil station of Malda.

The first specific notice of the city of Gaur, from actual knowledge, is contained in the Persian history called Tabaqât-i-Nasirí, which has been partially translated in Elliot's History of India. The author visited Lakhnaoti in 1243, but the only particular regarding the city that he mentions is that Ghiyasuddin 'Iwaz, the fourth Mohammedan ruler of Lakhnaoti (who called himself sultan, and acording to this writer, struck coin in his

own name), besides founding mosques, etc., carried embanked roads across the low country e. and w. of the city for a space of ten days' journey. These works in part still exist. "Radiating n., s., and e. of the city, . . . embankments are to be traced running through the suburbs, and extending in certain directions for 30 or 40 m." (Ravenshaw, p. 8). The extent of ground over which the remains of Gaur are spread is astonishing; and a large part of it would appear to be still, as well described a century ago, covered with dense wood or with rank jungle of grass and reeds, though in later years cultivation has somewhat extended over the site. What may be called the site of Gaur proper is a space of an oblong form, extending from n. to s. 7½ m., with a breadth varying from 1½ to 2 miles. This area is washed on one of its long sides (the western) by a stream called the Bhagirathi, which undoubtedly occupies a former bed of the Ganges (not to be confounded with the Bhagirathi further s., contributing to form the Hoogly, on which Calcutta stands). Roughly parallel to the eastern side, but at a distance varying from 2 to 6 m., runs the river Mahananda, whilst extensive swamps and sheets of water are interposed between this river and the city. The extensive area of which we speak has been defended on n., w., and s. by a rampart and ditch, whilst on the e. side there is a double embankment of great size, with two ditches, of immense width, and in some parts three. It is not quite clear from the description in what degree these latter works are intended respectively for defense or for protection from floods; but the latter must have been the main purpose. The Ain-i-Akbari (c. 1590) alludes to the fact that "if the earthen embankment broke, the town was under water." The position of the city, midway between two rivers of deltaic character, is low, and any rise in those rivers would raise the level of the marshes. Still the mass of these banks, as much as 200 ft. thick at the base, and 40 ft. in height, is greater than any present exposure to flood seems sufficient to explain. It has sometimes been supposed that the Ganges, since the foundation of Gaur, has flowed to the eastward, where is now the bed of the Mahananda. If this were so, the massive character of the embankment would be more intelligible. It would appear, however, that the positive testimony to this circumstance, which was at one time supposed to exist, depended on a mistaken reading of the passage referred to above, of the Tabaqát-i-Násirí. These great embankments have been originally faced throughout with masonry, whilst the crest shows numerous traces of edifices, but the whole of the earthworks are now overgrown with dense jungle. The Ganges now flows at a distance varying between 5 and 12 m. to the w. of the inclosed area of the city, but there seems to be no doubt that in the earlier centuries of its occupation the great river washed its western wall, where now the Bhagirathi flows. On this side, near the southern end, stood the citadel or royal fortress, stretching for a mile along the river bank, and marked out by the remains of a huge rampart of irregular trace, 180 ft. wide at the base, and faced with masonry, with numerous circular bastions. Shapeless masses of ruin fill the interior. The palace itself forms a rectangular inner inclosure of 2,100 ft. by 750, girt by a splendid brick wall, 18 ft. thick at bottom, 8½ ft. thick at top, and 42 ft. in height. To the northward the western embankment is prolonged far beyond the northern limit of the city, and about 3 m. n. of the latter we encounter a vast line of earthwork stretching from the prolongation just mentioned, in an irregular curve eastward and then south-eastward to the vicinity of the Mahananda river, in all for more than 6 miles. This also was probably intended chiefly as a defense against inundation of the suburbs. A huge excrescence protruding from the line, and overgrown with forest trees, incloses an area of nearly a square mile, which tradition points out as the palace of one of the Sena kings. Still n. of this, and extending to the banks of the Kalindri river, some 8 m. further, are found traces of ancient Hindu buildings. Turning again to the southern extremity of Gaur, for 6 or 7 m. to the s. of the city, there seems to have extended, still under the protection of a western embankment, a continuous chain of suburbs. In the northern portion, at least, of these, "prostrate domes, mingled with carved lintels and innumerable bricks, are seen lying in confusion on all sides, and show how dense has been the population." Thus from n. to s. the whole extent of ground bearing indications of urban occupancy is hardly less than 20 miles. We may, however, feel confident that, as in the case of Delhi, these traces comprehend a space within which the royal city occupied various localities in various ages. Traditions, collected by Dr. Francis Buchanan, placed the residence of the older Sena kings on the site at the extreme n. near the Kalindri. The southern part of the fortified area of Gaur, with the citadel and palace, was evidently, as we shall see from the dates of the buildings, the seat of the later kings who immediately preceded the absorption of Bengal into the Moghul empire in the latter half of the 16th century. The exact site occupied by Mohammed Bakhtiyar Khilji and his successors does not seem to have been determined. Throughout the interior length of Gaur run embanked roads, whilst the whole area is thickly dotted with excavated tanks of all sizes, up to the great Sagar Dighi (or "Ocean Tank"), a rectangular sheet of water measuring little short of a mile by half a mile. This vast work is probably to be referred to the Hindu age. The former existence of six ghauts of masonry can be traced on its banks, which are densely wooded to the water's edge. Numerous excavated channels also run in every direction, the earth from which appears to have served to raise the inhabited surface. The remaining buildings of importance are scattered at wide intervals over

the area, but the soil is throughout covered with fragments of brick, etc., in a manner which leaves no doubt of the former density of population. But Gaur has repeatedly been a quarry of building material. The old Lakhnaoti was robbed to build the mediæval capital of Pandua, and the later Gaur probably to build Rajmahl, whilst in more recent times their brick and stone were transported as merchandize to Malda, Moorshedabad, Hoogly, Rungpore, and even (as regards the more valuable kinds of stone) to Calcutta. In the revenue returns of Bengal, at the time of its transfer to the Company, there was an entry of an annual levy of 8,000 rupees, "as Gaur brick royalty," from landholders in the neighborhood of Gaur who had the exclusive right of dismantling its remains. The bricks of Gaur, Rennell says, are of extraordinary solidity of texture and sharpness of edge. The facilities which the site affords for water carriage during the rainy season greatly aided this systematic spoliation. That no Hindu buildings remain from the earlier cities is probably to be accounted for by this process of destruction. [*Encyc. Brit.*, 9th ed.]

GAU'RITZ, a river of the s. coast of the Cape Colony, in South Africa, forms the eastern boundary of the district of Zwellendam, entering the sea a little to the w. of Mossel bay. Like nearly all the streams of this region, it is rapid, and almost useless for the purposes of navigation.

GAUSS, KARL FRIEDRICH, one of the most illustrious mathematicians of modern times, was b. at Brunswick on April 30, 1777. In 1795, he went to the university of Göttingen, where, at this early age, he made a number of important discoveries, one of which may be mentioned, as it had occupied the attention of geometers from the time of Euclid, viz., the division of the circle into 17 equal parts. He soon afterwards returned to Brunswick, and there, in 1801, published his *Disquisitiones Mathematicæ*, a work treating of indeterminate analysis or transcendental arithmetic, which contains, besides other important theorems, a new demonstration of that of Fermat concerning triangular numbers. While Gauss was at work on these speculations, he was in great measure ignorant of what had been done in the same subject by previous mathematicians, which accounts for the presence in his work of a number of old theorems. But the discovery of the planet Ceres on the first day of the 19th c. guided the energies of Gauss into a new field of research. He was one of the first to calculate the elements of its orbit, according to methods of his own invention, and his assiduous application, and the accuracy of his results, excited general admiration. On the discovery of Pallas by Olbers in 1802, Gauss set himself to calculate its orbit; and his results, valuable at the time, are even now models of ingenuity and research. For these labors, he received, in 1810, from the French institute, the medal founded by Lalande. In 1807, he was appointed director of the observatory at Göttingen, an office peculiarly suited to his tastes, and about this time commenced to prepare for publication his celebrated work, *Theoria Motus Corporum Cœlestium in Sectionibus Conicis Ambientium*, which appeared in 1809. In this work, Gauss has developed a method of calculating, in the most simple, and at the same time most exact manner, the orbits of the bodies in the solar system. It is also to him that the credit is chiefly due of discovering the great comet of 1811, the elements of whose orbit he calculated with the most surprising accuracy.

In 1821, Gauss was charged by the Hanoverian government with the triangulation of the kingdom of Hanover, and the measurement of an arc of the meridian. In executing this work, Gauss found that the appliances then in use did not allow of the vertices of the triangles being seen from a considerable distance with sufficient distinctness, and to remedy this defect, he invented the heliotrope (q.v.). About 1831, Wilhelm Edward Weber arrived at Göttingen, and communicated to Gauss a part of his own enthusiasm for magnetic researches. It would take up too much space to give a full account of the many discoveries he made in this new branch of study; suffice it to say, that he has invented a "magnetometer" which measures the "magnetic intensity" with great accuracy, and that he has probably contributed more to the advancement of this branch of science than any one before him. Gauss was pronounced by La Place to be the greatest mathematician of Europe. He died at Göttingen on Feb. 23, 1855. Among his most celebrated works, besides the two above mentioned, are the *Disquisitio de Elementis Ellipticis Palladis ex Oppositionibus Annorum* 1803–9 (1810); *Theoria Combinationis Observationum Erroribus Minimis Obnoxiæ* (Göttingen, 1828), containing a full explanation of his peculiar method above mentioned; *Intensitas vis Magneticæ Terrestris ad Mensuram Absolutam Revocata* (1832), etc.

GAUSSEN, LOUIS, 1790–1863, was b. in Geneva, and in 1816 became pastor of Satigny, near that city. Here he derived profit from intercourse with pastor Cellerier, who had continued a steadfast Christian in the midst of the declension that was spreading among the Swiss clergy. About this time, through the labors of James and Robert Haldane, of Scotland, genuine religion was greatly revived in Switzerland. But as the work was distasteful to the majority of the Geneva ministers, the *Vénérable Compagnie des Pasteurs* passed ordinances against it which seriously restrained Christian liberty. In opposition to them, Gaussen and Cellerier republished in French the Helvetic confession, with a preface defending the use of confessions of faith. Gaussen labored zealously in Satigny 12 years, and became known throughout Switzerland as a faithful defender of true Christianity, seeking not to divide the church, but to infuse into it

new supplies of spiritual life. His activity and his doctrines were equally offensive to the opposite party, and involved him in frequent collisions with the *Vénérable Compagnie.* They ordered him to use the mutilated and rationalistic catechism which had been substituted for Calvin's, and, on his refusal, they censured him. He persevered in his course, and, together with Merle (d'Aubigne) and Galland, formed the "evangelical society" for the circulation of Bibles and tracts. The consistory at last suspended him. In 1834, he became professor of theology in the new evangelical school at Geneva, where he taught a strictly orthodox Christianity, but perhaps without sufficient regard to the peculiarities of modern thought. His Theopneus (1840), translated in England and America, maintains, in a form stronger than now commends itself to the majority of evangelical thinkers, the verbal inspiration of the Scriptures. His other writings that have been translated into English are: *Canon of Scripture; Geneva and Jerusalem; Geneva and Rome; It is written; Scripture proved to be from God; Lessons for the Young on the Six Days of Creation.*

GAUTAMA. See BUDDHISM, *ante.*

GAUTIER, THÉOPHILE, 1811–72; b. at Tarbes, France; educated at the grammar school of that town, and afterwards at the collége Charlemagne in Paris, where it does not appear that he particularly distinguished himself, though in later life his remarkable literary faculty and instinct enabled him to give to much of his work an air of scholarship and almost of erudition. He very early devoted himself to the study of the older French literature, especially that of the 16th and the early part of the 17th centuries. This study qualified him well to take part in the romantic movement, and enabled him to astonish Sainte-Beuve by the phraseology and style of some literary essays which, when barely eighteen years old, he put into the great critic's hand. In consequence of this introduction he at once came under the influence of the great romantic *cénacle*, to which, as to Victor Hugo in particular, he was also introduced by his gifted but ill-starred schoolmate, Gerard de Nerval. With Gerard, Petrus Borel, Corot, and many other less known painters and poets whose personalities he has delightfully sketched in the articles latterly collected under the titles of *Histoire du Romantisme*, etc., he formed a minor romantic clique who were distinguished for a time by the most extravagant eccentricity. A flaming crimson waistcoat and a great mass of waving hair were the outward signs which qualified Gautier for a chief rank among the enthusiastic devotees who attended the rehearsals of Hernani with red tickets marked "Hierro," performed mocking dances round the bust of Racine, and were at all times ready to exchange word or blow with the *perruques* and *grisatres* of the classical party. In Gautier's case, however, whatever they might be in others, these freaks were not inconsistent with real genius and real devotion to sound ideals of literature. He began (like Thackeray, to whom he presents in other ways some striking points of resemblance) as an artist, but soon found that his true powers lay in another direction. His first considerable poem, *Albertus* (1830), displayed a good deal of the extravagant character which accompanied rather than marked the movement, but also gave evidence of uncommon command of language and imagery, and in particular of a descriptive power hardly to be excelled. The promise thus given was more than fulfilled in his subsequent poetry. The *Comedie de la Mort*, which appeared soon after (1832), is one of the most remarkable of French poems, and though never widely read, has received the suffrage of every competent reader. Minor poems of various dates, published in 1840, display an almost unequaled command over poetical form, an advance even over *Albertus* in vigor, wealth, and appropriateness of diction and abundance of special poetical essence, which is so often absent in the most finished poetical work. All these good gifts reached their climax in the *Émaux et Camées*, first published in 1856, and again, with additions, just before the poet's death in 1872. These poems are in their own way such as cannot be surpassed. Gautier's poetical work contains in little an expression of his literary peculiarities. There are, in addition to the peculiarities of style and diction already noticed, an extraordinary feeling and affection for beauty in art and nature—an indifference nearly absolute to everything beyond this range, and which has doubtless injured the popularity of his work to almost as great a degree as that in which it has increased its special excellence and its charm to those who have a taste for it. But it was not as a poet that Gautier was to achieve either profit or fame. Thrown as he was into circles which were nothing if not literary, it was natural that he should attempt all literary forms, and certain, considering his powers, that he would be successful in all. For the theater, however, he had but little gift, and his dramatic efforts (if we except certain masks or ballets in which his exuberant and graceful fancy came into play) are by far his weakest. For a time he acted as secretary for Balzac, but found his occupation uncongenial enough, though it left some traces in his independent work. His first novel of any size, and in many respects his most remarkable work, was *Mademoiselle de Maupin.* Unfortunately this book, while it established his literary reputation on an imperishable basis, was unfitted by its subject, and in parts by its treatment, for general perusal, and created even in France a prejudice against its author which he was very far from really deserving. During the years from 1833 onward, his fertility in novels and tales was very great. *Le Jeune France*, which may rank as a sort of prose *Albertus* in some ways, displays the follies of the youthful romantics in a vein of humorous and at the

same time half-pathetic satire. *Fortunio*, perhaps, belongs to the same class. *Jettatura*, written somewhat later, is less extravagant and more pathetic. A crowd of minor tales display the highest literary qualities, and rank with Merimee's at the head of all contemporary works of the class. First of all must be mentioned the ghost story of *La Morte Amoureuse*, a gem of the most perfect workmanship. For many years Gautier continued to write novels. *La Belle Jenny* is not a very successful attempt to draw on his English experience, but the earlier *Militona* is a most charming picture of Spanish life. In *Spirite* he endeavored to enlist the fancy of the day for supernatural manifestations, and his *Roman de la Momie* is a learned study of ancient Egyptian ways. His most remarkable effort of this kind, towards the end of his life, was *Le Capitaine Fracasse*, a novel of the school of Dumas, projected nearly 30 years before. This book contains some of the finest instances of his literary power. It was, however, neither in poems nor in novels that the main occupation of Gautier as a literary man consisted. He was early drawn to the lucrative task of feuilleton writing, and for more than 30 years he was among the most expert and successful practitioners of this art. Soon after the publication of *Mademoiselle de Maupin*, in which he had not been too polite to journalism, he became irrevocably a journalist. The rest of his life was spent either in Paris, or in travels of considerable extent to Spain, the Netherlands, Italy, Turkey, England, Algeria, and Russia, all undertaken with a more or less definite purpose of book-making. Having absolutely no political opinions, he had no difficulty in accepting the second empire, and received from it considerable favors, in return for which, however, he in no way prostituted his pen, but remained a literary man pure and simple. Accounts of his travels, criticisms of the theatrical and literary works of the day, obituary notices of his contemporaries, and, above all, art criticisms, occupied him in turn. In the last department he has never had a superior, nor perhaps, except in the cases of Diderot and a great living English critic, an equal. [*Encyc. Brit.*, 9th ed.]

GAUZE, a light transparent silken fabric, supposed to have derived its name from having first been manufactured in Gaza, a city of Palestine. France and Switzerland produce considerable quantities of gauze. The chief seats of the manufacture in Great Britain are Paisley and Glasgow, and the surrounding districts. The openness of texture is obtained by crossing the warp threads between each thread of the weft, so that the weft passes through a succession of loops in the warp, and the threads are thus kept apart, without the liability to sliding from their places, which would take place if simple weaving were left so loose and open. Inferior qualities of gauze are made of a mixture of silk and cotton.

GAUZU-VIVA, a delicately formed deer of Brazil, of a grayish-brown color, with small horns. The animal is very little over 2 ft. in length.

GAVARNI, 1801–66. French caricaturist, b. Paris. His true name was Chevalier (Sulpice Guillamane), and he is said to have taken the *nom de plume* under which he is known from the place where he made his first published sketch. His parents were poor, and he started in life as a workman in an engine-building factory. At the same time he attended the free school of drawing. Here his natural talent was developed, and he acquired that training of the hand without which an artist is unable to work up his best inspirations. In his first attempt to turn his abilities to some account he met with many disappointments, but was at last intrusted with the drawing of some illustrations for a journal of fashion. Gavarni was at this time 34 years of age. His sharp and witty pencil gave to these generally commonplace and unartistic figures a life-likeness and an expression which soon won for him a name in fashionable circles. Gradually he gave greater attention to this more congenial work, and finally ceased working as an engineer to become the director of the journal *Les Gens du Monde*. His ambition rising in proportion to his success, Gavarni from this time followed the real bent of his inclination, and began a series of lithographed sketches, in which he portrayed the most striking characteristics, foibles, and vices of the various classes of French society. The letter-press explanations attached to his drawings were always short, but were forcible and highly humorous, if sometimes trivial, and were admirably adapted to the particular subject. The different stages through which Gavarni's talent passed, always elevating and refining itself, are well worth being noted. At first he confined himself to the study of Parisian manners, more especially those of the Parisian youth. He had ceased to be director of *Les Gens du Monde*, but he was engaged as ordinary caricaturist of *La Charivari*, and, whilst making the fortune of that paper, he made his own. His name was exceedingly popular, and his illustrations for books were eagerly sought for by publishers. *Le Juif Errant*, by Eugene Sue, the French translation of Hoffman's tales, the first collective edition of Balzac's works, *Le Diable a Paris*, *Les Francais peints par eux-memes*, the collection of physiologies published by Aubert in 38 vols., all owed a great part of their success at the time, and are still sought for, on account of the clever and telling sketches contributed by Gavarni. A single frontispiece or vignette was sometimes enough to secure the sale of a new book. Always desiring to enlarge the field of his observations, Gavarni soon abandoned his once favorite topics. He no longer limited himself to such types as the lorette and the Parisian student, or to the description of the noisy and popular pleasures of the capital, but turned his mirror to the grotesque sides of family life and of humanity at large. *Les*

Enfants Terrible; Les Parents Terrible; Les Fourberies des Femmes; Politique des Femmes; Les Maris Vengés; Les Nuances du Sentiment; Les Reves; Les Petits Jeux de Société; Les Petits Malheurs du Bonheur; Les Impressions de Menage; Les Interjections; Les Traductions en Langue Vulgaire; Les Propos de Thomas Vireloque, etc., were composed at this time, and are his most elevated productions. But whilst showing the same power of irony as in his former works, enhanced by a deeper insight into human nature, they generally bear the stamp of a bitter and even sometimes gloomy philosophy. This tendency was still more strengthened by a visit to England in 1849. He returned from London deeply impressed with the scenes of misery and degradation which he had observed among the lower classes of the city. In the midst of the cheerful atmosphere of Paris he had been chiefly struck by the ridiculous aspect of vulgarity and vice, and he had laughed at them. But the debasement of human nature which he saw in London appears to have affected him so forcibly that from that time the cheerful caricaturist never laughed or made others laugh. What he had witnessed there became the almost exclusive subject of his drawings, as powerful, as impressive as ever, but better calculated to be appreciated by cultivated minds than by the public, which had in former years granted him so wide a popularity. Most of these last compositions appeared in the weekly paper *L'Illustration*. In 1857, he published in one volume the series entitled *Masques and Visages*, and in 1869, about two years after his death, his last artistic work, *Les Douze Mois*, was given to the world. Gavarni was much engaged during the last period of his life in scientific pursuits, and this fact must perhaps be connected with the great change which then took place in his manner as an artist. He sent several communications to the *academie des sciences*, and till his death he was eagerly interested in the question of aerial navigation. It is said that he made experiments on a large scale with a view to find the means of directing balloons; but it seems that he was not so successful in this line as his fellow-artist, the caricaturist and photographer Nadar. [*Encyc. Brit.*, 9th ed.]

GAVAZ'ZI, Alessandro, a popular Italian preacher and reformer, distinguished by his patriotic zeal in promoting the civil and religious progress of his country, was b. at Bologna in 1809. At the early age of 16, he became a monk of the Barnabite order, and subsequently was appointed professor of rhetoric at Naples, where he speedily acquired great reputation as an orator. By his uncompromising advocacy of church and state reformation, he earned at once the enthusiastic admiration of the progressive party among his countrymen, and the bitter enmity of the priestly and ruling powers.
On the accession of Pius IX. to the papal chair, Gavazzi was one of the foremost supporters of the liberal policy that inaugurated that pontiff's reign; and having repaired to Rome, he devoted himself to the diffusion of political enlightenment and patriotic aspirations among the masses of the Roman population. The pope sanctioned his political labors and appointed him almoner of a body of 16,000 Roman troops, who volunteered for the campaign of Lombardy in 1848, and quitted Rome to proceed to Vicenza. To Gavazzi's fervid and patriotic oratory may be attributed, in no slight degree, the universal spirit of self-sacrifice evoked throughout Italy during this period of her history. He was called the *Pietro Eremita*, or Peter the hermit of the national crusade. The Roman legion having been recalled by the pope, Gavazzi continued in Florence, Genoa, and Bologna, to agitate in favor of the national movement. On the establishment of the republic at Rome, he was appointed almoner-in-chief to the national army. Under his superintendence, efficient military hospitals were organized and attended by a band of Roman ladies, who volunteered their services and co-operation in the care of the wounded. Rome having fallen, Gavazzi escaped to England, where he delivered numerous addresses and lectures, illustrative of the political and religious aims of his country. He afterwards visited the chief towns of Scotland, in every one of which he received a hearty welcome. In 1851, Gavazzi published his *Memoirs* in English and Italian; and, a few months later, a selection of his *Orations*. From Scotland the Italian orator proceeded to the United States, where he was rather coldly received; and when he went to Canada his public appearances, on more than one occasion, nearly caused a riot. Gavazzi was present with Garibaldi at Palermo during the expedition of 1860. He again visited London in 1870, and has since then repeatedly visited England and Scotland, preaching and lecturing in aid of the funds of the (Protestant) Italian Free Church (*Libera Chiesa*).

GAV'ELKIND. Lappenberg, who, though a foreigner, when indorsed by his translator Thorpe, may be considered as the very highest authority on the subject of English social antiquities, thus speaks of the custom of gavelkind: "A fact worthy of notice is the existence down to recent times of the old British law of succession in Wales, Kent, and some parts of Northumberland, called gavelkind. As far as we are enabled to understand it, in its mixture with Anglo-Saxon law, all the sons of the father inherited, but the youngest possessed the homestead; the eldest, or the next following capable of bearing arms, had the heriot—that is, the arms offensive and defensive of his father, and his horse. Even the son of an outlaw could not be deprived of the entire succession, but of the half only" (vol. i. p. 89). Though a Celtic origin is here, as by Blackstone (Stephen, iv. p. 548), probably with reason, ascribed to this tenure, it seems to be the general opinion of legal antiquaries (Selden, *Analect.* l. 2, c. 7; Stephen, vol.

l. 218) that it prevailed over the whole kingdom in Anglo-Saxon times, and that in Kent and elsewhere it was among the "liberties" which the people were permitted to retain at the conquest. Most of the many derivations which have been suggested for the word are, moreover, Teutonic—*gif eal cyn*, equivalent to Lord Coke's *gave all kinde*, or the custom which gives to all children alike, being the most probable. In Wales, gavelkind obtained universally till the time of Henry VIII. (34 and 35 Henry VIII. c. 26), and in some parts of England it is not yet abolished. In Kent, all lands that have not been disgaveled by act of parliament, are held to be gavelkind—a fact which ought to be borne in mind in all transactions with Kentish property. In addition to the characteristics of this tenure already noticed, Blackstone mentions the following: "1. The tenant is of age sufficient to alien his estate by feoffment at the age of 15. 2. The estate does not escheat in case of an attainder for felony; their maxim being, "the father to the bough, the son to the plough." 3. In most places, the tenant had a power of devising lands by will before the statute authorizing the devise of lands generally was made."

GAVIAL (*Gavialis*), a genus of reptiles of the crocodile (q.v.) family, conspicuously differing from true crocodiles and from alligators in the great length and slenderness of the muzzle. Another peculiar character is a large cartilaginous swelling at the extremity of the muzzle in the males, around the orifice of the nostrils. The teeth are very numerous, about 120; they are more equal in size than those of the other animals of this family, although some of the first are rather larger than the rest, the longest of the lower jaw being received into notches in the upper, as in the true crocodiles. The head is very broad, the narrow muzzle begins abruptly, and in it the branches of the bone of the lower jaw are united and prolonged as one. There are two great perforations in the bones of the skull behind the eyes, externally marked by depressions. The plates which cover the back and the nape of the neck are united. The crest of the tail is much elevated; the feet are webbed to the extremity of the toes; the whole habits as aquatic as those of the crocodile of the Nile. The only perfectly ascertained species, *G. Gangeticus*, inhabits the Ganges. It attains a greater size than any other of the recent *crocodilidæ*, frequently attaining the length of 25 ft.; but owing to the slenderness of its muzzle, it is esteemed less dangerous than a true crocodile of smaller size. The form of the muzzle seems particularly to adapt it for preying on fish. The cartilaginous swelling at the extremity of the muzzle seems to have given rise to Ælian's statement, that the crocodile of the Ganges had a horn at the tip of its snout. Fossil gavials, different from the existing species, have been found in eocene deposits, as at Bracklesham, in England.

GAVILAN MOUNTAINS, a group or chain in Monterey co., Cal., near the coast of the Pacific. The highest point is Mt. Pacheco, about 2,850 ft. above the sea.

GAVINANA, or CAVINANA, a village of 622 inhabitants, picturesquely situated amid the Tuscan Apennines, in the valley of the river Lima, owes its interest to the memorable battle fought around its walls in 1530, between the republican forces of Florence, led by their great capt., Ferruccio, and the imperialists headed by Philibert, prince of Orange. The Florentines were defeated with the loss of their commander; and the death of Ferruccio, whose name in Tuscany has become synonymous with chivalry and patriotism, gave the final blow to the liberties of the republic.

GAVOTTE, a piece of music of a lively character, peculiarly suitable for dancing, but more adapted for the stage than for private performance. It consists of two repetitions of eight bars each, beginning with an up-beat, and is in alla-breve time. The fundamental rhythm of the gavotte is therefore

by which the second bar has a remarkable cæsura. Formerly, the gavotte was often introduced into sonatas and other pieces, where its form was not so strictly adhered to; still the eight-bar repetition was always considered necessary.

GAY, DELPHINE. See GIRARDIN, EMILE DE, *ante*.

GAY, EBENEZER, 1696–1787, b. Mass.; graduated at Harvard, and settled as a minister in 1718. When he was 85 years old he preached a sermon which has been frequently republished under the name of *The Old Man's Calendar*. His theological views were very liberal.

GAY, JOHN, was b. at Barnstaple, in Devonshire, in 1688. Although of an ancient family, his father was in reduced circumstances, and Gay was apprenticed to a London silk-mercer; but disliking his occupation, he was finally released from it by his master. In 1711, he published a descriptive poem dedicated to Pope. The year after, he was appointed secretary to the duchess of Monmouth. His next work was *The Shepherd's Week, in Six Pastorals*, which gained considerable applause. About the same time he produced *Trivia* and *The Fan*, full of descriptions of low city-life, a good deal in Swift's style—indeed, he was assisted by Swift in the former work. In 1713, appeared his comedy, *The Wife of Bath*, which did not succeed. Next year, he relinquished his sit-

uation in the family of the duchess of Monmouth, and accompanied lord Clarendon, then envoy-extraordinary to Hanover, as his secretary. Within two months, he was again in London, where, at the instigation of Pope, he wrote a poem on the royal family, and shortly afterwards produced his play, *What d'ye Call It?* Encouraged by its success, he brought out another play, entitled *Three Hours After Marriage*, which failed signally. In 1720, he published his poems by subscription, and is said to have realized £1000 thereby. He at the same time received a present of South Sea stock, and was considered a rich man, when all his sudden fortune was lost in the collapse of that famous bubble. In 1724, he produced his play of *The Captives*, and wrote a volume of *Fables* in 1726. When Swift came to live with Pope at Twickenham in 1726, he talked to Gay of a Newgate pastoral, and *The Beggars' Opera* was the result. The success of this piece was immense; it had a run of sixty-three nights, and took captive town and country. Gay afterwards wrote a sequel, entitled *Polly*, but owing to some misunderstanding with the lord chamberlain, its representation was prohibited. On its publication, it brought the author £1200. About this time, he went to live with the duke of Queensberry, and remained with him during the rest of his life. He was seized with an inflammatory fever, and died after an illness of three days. His death took place on Dec. 4, 1732, and he was buried in Westminster Abbey.

Although more than a century has elapsed, and the satire and allusions are obsolete, *The Beggars' Opera* is still occasionally represented. It exists, however, mainly in virtue of its songs and music. Gay had a happy lyrical vein, and could turn a stanza on the beauty of woman, and the fascinations of the wine-cup, and the fleeting of youth, with considerable grace. His *Fables*, and his serious and comic poems, are only now to be found in libraries. The wit and the sentiment are alike dust. Of all he has done, his ballad of *Black-eyed Susan* possesses the strongest vitality, and thrills now and then our theatres and concert-rooms.

GAY, Marie Françoise Sophie, Madame, 1776–1852, daughter of M. Nichault de Lavalette (who was attached to the household of Monsieur, afterwards Louis XVIII.) and of Francesca Peretti, a Florentine lady. Under the guidance of her father, she received a very careful education. In 1793, she was married to M. Liottier, an exchange broker, but was divorced from him in 1799, and shortly afterwards married M. Gay, receiver-general of the department of the Roer or Ruhr. This union brought her into more intimate relations with many distinguished personages whom she had previously known; and her circle of acquaintainces gradually extended, until her salon came to be frequented by all the distinguished litterateurs, musicians, actors, and painters of the time, among whom she made herself remarked by her beauty, her vivacity, and her sprightly wit tempered by fine tact and genuine amiability. Her first literary production was a letter written in 1802 to the *Journal de Paris*, in defense of Madame de Stael's novel *Delphin*; and in the same year she published her first novel, *Laure d'Estell*, anonymously. *Leonie de Montbreuse*, which appeared in 1813, is considered by Sainte-Beuve her best work; but *Anatolie*, which appeared in 1815, has perhaps a higher reputation. These and several of her other works, amongst which may be specially named *Les Salons celebres*, possess interest beyond their intrinsic merit, on account of their purity and elegance of style, for their portraitures of French society especially during the period of the directory and the consulate, and of many of the distinguished personages whose intimacy she enjoyed. Madame Gay wrote several theatrical pieces which won considerable success. She was also an accomplished pianist and harpist, and composed both the words and the music of a number of romances.

GAY, Winckworth Allan, b. Mass., 1821; a landscape painter, pupil of prof. Robert Weir at West Point and of Constant Troyon in Paris. His pictures of New England scenery are highly esteemed.

GAYÁ, a district of British India in the Patna division, under the lieutenant-governor of Bengal, situated between 24° 17′ and 25° 19′ n., and 84° 4′ and 86° 5′ east. It is bounded on the n. by Patna, on the e. by Monghyr, on the s.e. and s. by Hazaribagh, and on the w. by Shahabad districts. Generally speaking, Gaya consists of a level plain, with a ridge of prettily wooded hills along the southern boundary, whence the country falls with a gentle slope towards the Ganges. Rocky hills occasionally occur, either detached or in groups, the loftiest being Maher hill, about 12 m. s.e. of Gaya town, with an elevation of 1620 ft. above sea-level. The eastern part of the district is highly cultivated; the portions to the n. and w. are less fertile; while in the s. the country is thinly peopled, and consists of hills, the jungles on which are full of wild animals. The principal river is the Son, which marks the boundary between Gaya and Shahabad, navigable by small boats throughout the year, and by crafts of 20 tons burden in the rainy season. The other rivers are the Pimpun, Phalgu, and Jamna, and a number of smaller streams. Two branches of the Son canal system, the eastern main canal and the Patna canal, intersect the district. The census of 1872 takes the area of Gaya district at 4,718 sq.m.; and returns the pop. at 954,129 males and 995,621 females—total, 1,949,750, residing in 6,530 villages or towns, and 327,845 houses. Classified according to religion, there are 1,729,890 Hindus, 219,332 Mohammedans, 208 Christians, and 316 "others." Amongst the higher caste there is an unusually large proportion of Brahmans, a circumstance due to the sacred places which the district contains. The Gaya-

wals, or priests in charge of the holy places, are held in high esteem by the pilgrims; but they are not pure Brahmans, and are looked down upon by those who are. They live an idle and dissolute life, but are very wealthy, from contributions extorted from the pilgrims. The ruined city of Buddh Gaya, about 6 m. s. of Gaya town, marks the residence of Sakya Sinha, the founder of the Buddhist religion, who flourished in the 6th c. B.C., and an ancient tree is pointed out as the identical fig tree under which the sage sat in abstraction for five years, until he attained to the state of Buddha. Another place of religious interest is a temple of great antiquity, which crowns the highest peak of the Baraber hills, and at which a religious fair is held each September, attended by from 10,000 to 20,000 pilgrims. At the foot of the hill are numerous rock caves excavated about 200 B.C. [*Encyc. Brit.*, 9th ed.]

GAY'AH, or GYA, the capital of the province of Behar, in the presidency of Bengal, stands on the Phalga, an affluent of the Ganges, in lat. 24° 48′ n., and long. 85° 4′ east. It contains (1871) 66,843 inhabitants; but as it is a place of great sanctity, being the birthplace of Buddha, the founder of the Buddhist religion, it is annually visited by at least 100,000 pilgrims. It consists of two towns—the older being reserved for the Brahmans and their immediate dependents. Silk and cotton manufactures are carried on, but the people rely chiefly on the expenditure of the superstitious visitors, some of whom have been known to leave behind them upwards of £5000.

GAYAL, *Bos Gavæus*, a species of ox, found wild in the mountains of Aracan, Chittagong, Tipura, and Sylhet, and which has long been domesticated in these countries and in the eastern parts of Bengal. It is about equal in size to the Indian buffalo; and, like the buffalo, it carries the head with the muzzle projecting forward. The head is very broad and flat at the upper part, suddenly contracted towards the nose; with short horns, a little curved, projecting nearly in the plane of the forehead, and a very wide space between them at the base. There is no proper hump, but a sharp ridge on the shoulders and fore-part of the back. The prevailing color is brown, generally dark. The Kookies keep herds of gayals, which they permit to roam at large during the day in the forests, but which return home at night of their own accord: to secure which the animals are occasionally supplied with a little salt, which has the greatest attractions for them. Their milk is extremely rich, but not abundant; the Kookies, however, do not use the milk, but rear them entirely for their flesh and skins.

GAYARRE, CHARLES E. ARTHUR, b. La. 1805; educated in the college of New Orleans; studied law and was admitted to the bar in 1829. Soon afterwards he published an essay on the history of Louisiana, which attracted much attention. He was a member of legislature, deputy attorney-general, and presiding judge of the New Orleans city court. He was chosen U. S. senator in 1835, but on account of ill-health did not serve. He was twice again elected to the legislature, and was for seven years secretary of state. Among his works are *Histoire de la Louisiana; Romance of the History of Louisiana; Louisiana, its Colonial History and Romance; Louisiana, its History as a French Colony; History of the Spanish Domination in Louisiana; Philip II. of Spain;* and some books of fiction.

GAY-FEATHER, the common name for the *liatris scariosa* and *spicata:* plants which are indigenous to the American soil, possessing bulbous roots, strong taste, and great remedial properties. A familiar local name for them is "rattlesnake master." They bear purple flowers, and are suitable for flower borders.

GAY-LUSSAC, LOUIS JOSEPH, one of the most distinguished chemists and physicists of recent times, was born on Dec. 6, 1778, at St. Léonard (Haute-Vienne). In 1794, he was sent to Paris to prepare for the examinations requisite for admittance into the polytechnic school; and his admission to that institution took place on Dec. 27, 1797. After three years' study, he was promoted to the department *Des Ponts et Chaussées.* Berthollet, who was then professor of chemistry in the polytechnic school, having recognized his zeal and talents for original research, selected him as his assistant at Arcueil, where the government chemical works were situated. The study of Dalton's *Experimental Essays*, published in 1801, directed the attention of the young chemist to the department of chemical physics. In that year he published his first memoir, which treated of "the dilatation of gases and vapors," and which was speedily followed by others on "the improvement of thermometers and barometers;" on "the tension of vapors, their mixture with gases, and the determination of their density, etc.:" and on "capillary action." In consequence of the reputation which he acquired from these researches, he was commissioned, in association with Biot, by the institute of France, to make a balloon ascent, with the view of ascertaining whether the magnetic force existed at considerable heights above the surface of the earth, or only on the surface, as had been asserted by some physicists. A notice of this ascent, and of another ascent which he made alone, is given in the article BALLOON. Alexander von Humboldt investigated with him the properties of air brought down from a height of more than 23,000 ft., and their joint memoir to the academy of sciences (read on Oct. 1, 1804) contained the first announcement of the fact, that oxygen and hydrogen unite to form water in the simple proportion of 100 parts by bulk (volumes) of the former to 200 parts of the latter. The simplicity of the ratio in which these gases stood to each other in their

combining proportions, induced him to study the combining volumes of other gases, and thus led him to the important discovery of the *law of volumes*, which was announced in 1808, and is one of the most general and important laws in the whole domain of chemistry. Davy's discoveries of potassium and sodium, by the decomposing action of the voltaic pile, having excited much attention in France, Napoleon directed Gay-Lussac and Thenard to pursue this class of researches. The results of these investigations appeared in their *Recherches Physico-chimiques*, in two volumes, published in 1811. Amongst the most important of the discoveries announced in these volumes, are a new chemical process which yields potassium and sodium much more abundantly than the voltaic pile, the determination of the composition of boracic acid both analytically and synthetically, and new and improved methods of analyzing organic compounds. (Boron was, however, simultaneously discovered in England by Davy.) Although the discovery of iodine (in 1811) is due to Courtois, it was Gay-Lussac who (in 1813) first described its distinctive properties, gave it the name which it now bears, and proved that it is an elementary body; he was also the first to form synthetically the compounds of iodine with hydrogen and oxygen, known as hydriodic and iodic acids. In 1815, he announced the discovery of cyanogen, which presented the first known example of a compound body (C_2N) exhibiting many properties which were previously believed to pertain specially to simple or elementary bodies. His memoir on this compound, in the 95th volume of the *Annales de Chimie*, is a model of what a complete and exhaustive chemical investigation should be. Our space will not allow of more than a passing allusion to his subsequent investigations regarding the fabrication of hydrated sulphuric acid, his essays on the bleaching chlorides, on the alcohols, and on the alkalies employed in commerce. In 1805, he was chosen a member of the committee of arts and manufactures, established by the minister of commerce. In 1818, he was appointed to superintend the government manufactory of gunpowder and saltpeter; and in 1829, he received the lucrative office of chief assayer to the mint, where he introduced several important chemical changes. In 1831, he became a member of the chamber of deputies; and in 1839, he was made a peer of France. He never, however, took an active part in politics, and was diligently engaged in scientific research until his last illness. For many years he was the editor, in association with Arago, of the *Annales de Chimie et de Physique*. He died at Paris May 9, 1850, from atrophy of the heart.

GAZA (Heb. signifies "strong"), (now called GUZZEH), a t. in the s.w. of Palestine, is situated about 3 m. from the sea, on the borders of the desert which separates Palestine from Egypt. It originally belonged to the Philistines, and was a place of importance at the period of the conquest of Canaan by the Israelites. It is frequently mentioned in the history of Samson; and after many vicissitudes in the wars between the Israelites and the Philistines, it was allotted to the tribe of Judah, in whose possession it finally remained. In the year 333 B.C., Gaza was taken by Alexander the great; and from that period down to 1799, when it was taken by the French under Kleber, it has been the scene of many battles and sieges. Constantine the great, who rebuilt the town, made it the seat of a bishop. The modern Gaza has the appearance of being a collection of mere villages. It has no gates, no fortifications or defenses of any kind. The only building of interest is the great mosque, with its tall octagonal minaret and peaked roof. Gaza has manufactures of soap and cotton stuffs; and, owing to its situation near the Mediterranean and on the caravan route to Egypt, it has a good trade both by sea and land. Pop. upwards of 15,000, from 200 to 300 of whom are Christians, and the rest Mohammedans.

GAZA, THEODORUS, a successor of Emanuel Chrysoloras as teacher of the Greek language and literature in the west. When his native city, Thessalonica, fell into the hands of the Turks, in 1430, he fled to Italy, where he studied the Latin language, under Victorinus of Feltre, at Mantua; after 1441, he was appointed rector of the newly established gymnasium, or high school, of Ferrara, and professor of Greek. He was invited by pope Nicholas V., along with other learned Greeks, to Rome, and was employed in making Latin versions of Greek authors. After the death of Nicholas, king Alfonso invited him to Naples in 1456; but two years after, the death of this monarch also necessitated his return to Rome, where he found a patron in cardinal Bessarion, who obtained for him a small benefice in the s. of Italy, either in Apulia or Calabria. Here he died in 1478, at an advanced age.

Gaza has been warmly praised by subsequent scholars, such as Politian, Erasmus, Scaliger, and Melanchthon. His principal writings are his *Introductivæ Grammatices*, libri iv. (a work on the elements of Greek grammar, first published by Aldus Manutius, at Venice, 1495 A.D., and long held in high repute), a number of epistles to different persons on different literary subjects, and a variety of important translations into Latin of portions of Aristotle, Theophrastus, St. Chrysostom, Hippocrates, and other Greek writers.

GAZE, in heraldry. When a beast of the chase, as a hart or stag, is represented as *affrontée*, or full-faced, it is said to be at gaze.

GAZELLE, *Antilope Dorcas* or *Gazella Dorcas*, a species of antelope, about the size of a roebuck, but of lighter and more graceful form, with longer and more slender limbs, in these respects exhibiting the typical characters of the antelopes in their highest per-

fection. It is of a light tawny color, the under parts white; a broad brown band along each flank; the hair short and smooth. The face is reddish fawn-color, with white and dark stripes. The horns of the old males are 9 or 10 in. long, bending outward and then inward, like the sides of a lyre, also backward at the base, and forward at the tips, tapering to a point, surrounded by thirteen or fourteen permanent rings, the rings near the base being closest together and most perfect. The horns of the female are smaller and obscurely ringed. The ears are long, narrow, and pointed; the eyes very large, soft, and black; there is a tuft of hair on each knee; the tail is short, with black hairs on its upper surface only, and at its tip. The gazelle is a native of the n. of Africa, and of Syria, Arabia, and Persia. Great herds of gazelles frequent the northern borders of the Sahara; and notwithstanding their great powers of flight, and the resistance which they are capable of making when compelled to stand at bay—the herd closing together with the females and young in the center, and the males presenting their horns all around—lions and panthers destroy them in great numbers. The speed of the gazelle is such that it cannot be successfully hunted by any kind of dog, but in some parts of the east it is taken by the assistance of falcons, of a small species, which fasten on its head, and by the flapping of their wings blind and confuse it, so that it soon falls a prey to the hunter. It is also captured in inclosures made near its drinking-places. Although naturally very wild and timid, it is easily domesticated, and, when taken young, becomes extremely familiar. Tame gazelles are very common in the Asiatic countries of which the species is a native; and the poetry of these countries abounds in allusions both to the beauty and the gentleness of the gazelle. It has been supposed that the gazelles of Asia may be of different species from the African, but there is reason to think that they are the same. The ariel gazelle (*A. Arabica*) perhaps differs rather as a variety than as a species, and is even more symmetrical and graceful than the common kind. There are several species very nearly allied to the gazelle, among which is *antilope* (or *gazella*) *Soemmeringii*, a native of Abyssinia, with the curvatures of the horns very marked and sudden.—Some confusion has arisen among naturalists as to the application of the name gazelle, originally Arabic; and it has not only been given to the *leucoryx* of the ancients, a very different species, but even to the *gemsboc* of South Africa. The true gazelle was known to the ancients, and is accurately described by Ælian under the name *dorcas*, which was also given to the roe.

GAZETTE. A gazette was a Venetian coin worth somewhat less than a farthing; and the name was hence applied to a sort of gossiping sheet, or primitive newspaper, that was sold for that sum at Venice. See NEWSPAPER. In its English acceptation, it means the official newspaper, in which proclamations, notices of appointments, and the like, are published by the government. The *Gazette* is said to have been published for the first time at Oxford in 1665. On the removal of the court to London, the title was changed to the *London Gazette*. It is now published on Tuesdays and Fridays. Proclamations printed in the *Gazette* are probative, without production. But the rule is different as to presentations or grants to private persons. Publication of a dissolution of partnership in the *Gazette* is not a sufficient notice to persons who were formerly in the habit of dealing with the company. Even as regards parties dealing for the first time, the tendency in England is to doubt the sufficiency of such notice in all cases; whereas, in Scotland, the opposite tendency prevails, and it is held that persons contracting with a company for the first time are bound to inquire into its existing condition, and consequently that notice even in a provincial newspaper may suffice. In practice, all reasonable means ought to be resorted to. Under the bankrupt act and other statutes, certain notices are directed to be given in the *Gazette*.

GAZETTEER. See DICTIONARY and ENCYCLOPÆDIA.

GAZOGENE. See AËRATED WATER.

GAZONS, in fortification, are sods laid over newly made earthworks, to consolidate them, and prevent the soil from rolling down.

GEARING, a term applied to the parts of machinery by which motion in one part of a machine is communicated to another; gearing consists in general of toothed-wheels, friction-wheels, endless bands, screws, etc., or of a combination of these. When the communication between the two parts of the machine is interrupted, the machine is said to be *out of gear;* and when the communication is restored, it is said to be *in gear.* In the case of a thrashing-mill, e.g., driven by a steam-engine, the gearing usually consists of an endless band which communicates motion from the axle of the fly-wheel to that of the drum. If the band were slipped off from one wheel, or slackened so that motion could not be communicated by means of it, then the machine would be *out of gear.* Gearing which can be put in and out of gear is called *movable gearing;* that which cannot, as, for instance, the wheel-work of a watch, is called *fixed gearing.* Gearing which consists of wheel-work or endless screws (q.v.) is put out of gear either by means of one of the wheels sliding along its axis, or being moved out of its place horizontally or vertically by means of a lever. *Straight gearing* is used when the planes of motion are parallel to each other; *bevelled gearing,* when the direction of the plane of motion is changed. See WHEELS, TOOTHED. Gearing has also for its object the increasing or diminishing of the original velocity, and in reference to this, is distinguished by the term "multiplying" or "retarding." See WHEELS, TOOTHED.

GEARY, John White, 1819–73; b. Penn.; studied at Jefferson college, and became a civil engineer; served in the war with Mexico, where he was wounded; in 1849 was appointed postmaster at San Francisco; was afterwards alcalde, and military governor, then judge. In 1856, he was appointed governor of Kansas, but was not fortunate in his administration. He raised Union troops on the outbreak of the rebellion, rose to be maj-gen., and obtained command of a division. In 1866, he was chosen governor of Pennsylvania, and re-elected in 1869.

GEAUGA, a co. in n.e. Ohio, on the Cuyahoga and Grand rivers, intersected by the Painesville and Youngstown railroad; 430 sq.m.; pop. '70, 14,190. The surface is undulating, and well adapted to cattle raising. The chief productions are wheat, corn, oats, potatoes, flax, maple sugar, wool, and butter. Co. seat, Chardon.

GEBA RIVER. See Senegambia.

GEBANG PALM, *Corypha Gebanga*, a fan-leaved palm, native of the East Indies, and one of the most useful palms of that part of the world. Its stem yields a kind of sago; its root is medicinal, being both emollient and slightly astringent, so as to be particularly adapted to many cases of diarrhea; its leaves are used for thatch, for making broad-brimmed hats, and for various economical purposes; its young leaves are plaited into baskets and bags, in the manufacture of which many of the people of Java find much employment; the fibers of its leaf-stalks are made into ropes, baskets, nets, cloth, etc.—To the genus *corypha* belongs also the Talipat Palm (q.v).—The fruit of *C. pumas*, a Mexican species, is eatable, and has a sweet taste.

GEBIR, Abu-Mussah-Jaafer Al Sofi, the founder of the Arabian school of chemistry, flourished towards the end of the 8th, or the commencement of the 9th century. The place of his birth is uncertain. According to the majority of authorities, he was born at Tûs, in Khorassan, but Abulfeda supports the claims of Harran in Mesopotamia. He was greatly esteemed in the east, and subsequently in Europe, where the chemists, down to the time of Van Helmont, did nothing more than repeat his experiments. Cardan reckons Gebir one of the twelve subtlest geniuses of the world, while Roger Bacon bestows upon him the epithet "magister magistrorum." He wrote an immense number of treatises on alchemy, of which a considerable number are extant in the form of Latin versions. The library of Leyden contains many manuscripts of Gebir's works which have never been published. In the imperial library at Paris there are manuscripts of his two celebrated works, the *Summa Collectionis Complementi Secretorum Naturæ*, and the *Summa Perfectionis*—also of a work on astronomy, and a treatise on spherical triangles. The principle laid down by Gebir at the commencement of his works is, that art cannot imitate nature in all things, but that it can and ought to imitate her as far as its limits allow. An edition of his works in Latin was published at Dantzic in 1682, and another in English by Russell (London, 1678). For information respecting Gebir's opinions with regard to alchemy, see Alchemy.

GEBWEILER (in French, Guebwiller), a t. of the German imperial province of Alsace-Lorraine, in the district of upper Alsace, situated about 13 m. s. of Colmar, at the mouth of the Blumenthal or "Vale of Flowers." It communicates by a branch line with the railway between Strasburg and Basel. Among the principal buildings are the Roman Catholic church of St. Leodgar, dating from the 12th c., the Evangelical church, the synagogue, the town-house, and the old Dominican convent, now used as a market and concert-hall. The spinning, weaving, bleaching, and dyeing of cotton is the chief industry, but woolen goods and silk ribbons, as well as machinery, are also manufactured. Gebweiler is mentioned as early as 774. It belonged to the religious foundation of Murbach, and in 1759 the abbots chose it for their residence. At the French revolution, 1789, however, the chapter-house was laid in ruins, and though the archives were rescued and removed to Colmar, the library perished in the devastation. Pop. '75, 11,622.

GECKO, *Gecko*, a genus of saurian reptiles, constituting a family, *geckotidæ*, which some recent naturalists have divided into many genera. The geckos are of small size, and generally of repulsive aspect; the colors of most of them are dull, and the small granular scales with which they are covered are in general mingled with tubercles. The legs are short, the gait usually slow, measured, and stealthy, although geckos can also run very nimbly when danger presses, and often disappear very suddenly when they seem almost to be struck or caught. The feet are remarkable, being adapted for adhering to smooth surfaces, so that geckos readily climb the smoothest trees or walls, or creep inverted on ceilings, or hang on the lower side of the large leaves in which tropical vegetation abounds. The body and tail are never crested, but are sometimes furnished with lateral membranes, variously festooned or fringed. The lateral membrane is sometimes even so large as to be of use to arboreal species in enabling them to take long leaps from branch to branch. The geckos feed chiefly on insects. They are more or less nocturnal in their habits. They are natives of warm climates, and are very widely distributed over the world. Two species are found in the s. of Europe, both of which frequently enter houses, as do the geckos of Egypt, India, and other warm countries. The name gecko is derived from a peculiar cry often uttered by some of the species, and which in some of them resembles syllables distinctly pronounced, whilst others are

described as enlivening the night in tropical forests by a harsh cackle. The geckos have, in almost all parts of the world where they are found, a bad reputation as venomous, and as imparting injurious qualities to food which they touch, but there is no good evidence in support of any such opinion, in accordance with which, however, an Egyptian gecko is even known as *the father of leprosy*.

GED, William, d. 1749, the inventor of the art of stereotyping, was b. at Edinburgh, about the beginning of the 18th century. In 1725, he first put in practice the art which he had discovered; and some years later he entered into a partnership with a London capitalist, with a view to employing it on a great scale. The partnership, however, turned out ill; and Ged, broken-hearted at his want of success, died in London. The only books which he produced by means of stereotyping were two prayer-books for the university of Cambridge, and an edition of Sallust.

GEDDES, a t. and village in Onondaga co., N. Y., on Onondaga lake, 5 m. n.w. of Syracuse; pop. of township, '75, 5,703; of village, 3,629. The village is noted for salt manufactures (boiling and evaporating the water of the numerous salt-wells), and for manufactures of iron and pottery.

GEDDES, Alexander, ll.d., a biblical critic, translator, and miscellaneous writer, was b. at Arradowl, in the parish of Ruthven, Banffshire, in 1737. His parents were Roman Catholics, and young Geddes was educated for a priest, first at Scalan, a monastic seminary in the Highlands, and subsequently at the Scots college, Paris, where he acquired a knowledge of Hebrew, Greek, Italian, French, Spanish, German, and Low Dutch. In 1764, he returned to Scotland, and, having taken orders, he was appointed officiating priest to the Roman Catholics of Angus, but after a short time went to reside with the earl of Traquair. In 1769, he undertook the charge of a Roman Catholic congregation at Auchinhalrig, in Banffshire, where he remained for ten years, making himself during that period honorably conspicuous by his charities and extraordinary liberality of sentiment. He was at length deposed from all his ecclesiastical functions, on account of his occasional attendance at the parish church of Cullen, between the minister of which and himself there existed an intimate acquaintance. Geddes now resolved to betake himself to literature, and proceeded to London in 1780. He had long planned a translation of the Bible into English for the use of Roman Catholics, and he was now, through the munificence of lord Petre, enabled to devote himself to the work. After various preliminary publications intended to pave the way for an impartial or favorable consideration of his *magnum opus*, there appeared in 1792 *The First Volume of the Holy Bible, or the Books accounted Sacred by Jews and Christians, otherwise called the Books of the Old and New Covenants, faithfully translated from Corrected Texts of the Originals, with Various Readings, Explanatory Notes, and Critical Remarks.* In 1793, the second volume was published, carrying the translation as far as the end of the historical books; and in 1800, a third volume was issued, containing his *Critical Remarks on the Hebrew Scriptures.* The opinions enunciated in these volumes, especially in the last, are startlingly heretical, more especially when the training of their author is considered, and were calculated, at the time of their appearance, to offend both Catholics and Protestants. They exhibit as thoroughgoing rationalism as is to be found in Eichhorn or Paulus. Moses is said to be inspired in the same sense as other good men; and in regard to his purpose, it is affirmed that "he only did what all other ancient legislators had done—required a greater or less degree of implicit obedience to their respective laws, and for that purpose feigned an intercourse with the Deity, to make that obedience more palatable to the credulous multitude." Miracles are explained away; and the account of the creation in Genesis is described as "a most beautiful mythos or philosophical fiction, contrived with great wisdom, and dressed up in the garb of real history." These opinions naturally enough exposed him to the charge of infidelity, and his criticisms were described as "less scurrilous, perhaps, but not less impious than those of Thomas Paine." All sorts of ecclesiastics united in their condemnation, and the undoubted effect of their hostility was to crush whatever hopes of literary fame Geddes may have entertained. He died at London, Feb. 26, 1802. It is now generally admitted, even by those who have no sympathy with his views, that Geddes' translation is in the main excellent, and that his remarks are often valuable. His labors have unquestionably advanced the science of biblical criticism. Among his other productions may be mentioned a poem on the *Confessional;* the *Battle of B—ng—n, or the Church's Triumph, a comic-heroic poem in nine cantos;* and *Bardomachia, or the Battle of the Bards.* See Life of Geddes by Good (1803).

GEDDES, James, 1763–1838; b. Penn., but removed to Onondaga co., N. Y. He was an early and ardent advocate of the Erie canal, one of the first surveyors of the route, and one of the engineers. He occupied the position of county judge, and was largely employed as engineer on canals in New York, Ohio, and Pennsylvania.

GEDDES, Janet, known in Scottish ecclesiastical history as "Jenny Geddes," has had her name transmitted as the person who took a prominent part in resisting the introduction of a service-book prepared by Laud, into the church of Scotland in 1637. The circumstances were these. Sunday, July 23, 1637, was the day fixed for this innovation, so obnoxious to the Scottish Presbyterians, and an immense crowd filled the High church

of St. Giles's, Edinburgh, on the occasion. On the dean of Edinburgh beginning to read, his voice was lost in a tumultuous shout, and an old woman, said to have been one Jenny Geddes, who kept a green-stall in the High street, bawling out: "Villain! dost thou say mass at my lug?" (that is ear), launched her stool at the dean's head. Universal confusion ensued, and the dean, throwing off his surplice, fled to save his life. The bishop of Edinburgh, on attempting to appease the storm, was assailed by a volley of sticks, stones, and other missiles, accompanied by cries and threats that effectually silenced him. This tumult proved the deathblow of the liturgy in Scotland. It has been doubted, however, if there ever was such a person as Jenny Geddes. In 1756, a citizen of Edinburgh, of the name of Robert Mein (who died in 1776), known for his exertions for the improvement of his native city, published a tract called *The Cross Removed, Prelacy and Patronage Disproved*, etc., in which he claims the exploit of Jenny Geddes for his great-grandmother, "the worthy Barbara Hamilton, spouse to John Mein, merchant and postmaster in Edinburgh, who, in the year 1637, spoke openly in the church at Edinburgh against archbishop Laud's new service-book, at its first reading there, which stopped their proceedings, and dismissed their meeting, so that it never obtained in our church to this day." In the obituary notice of Robert Mein, *Weekly Magazine*, vol. xxxix., and *Scots Magazine*, vol. xxxvi. (1776), this Barbara Hamilton is said to have been descended from the Hamiltons of Bardowie, "but was better known in our history by the name of Jenny Geddes, though called so erroneously." Jenny Geddes's famous stool is said to have been burned by herself in the bonfires at the cross of Edinburgh at the restoration, and what has been called hers in the museum of the society of antiquaries at Edinburgh, has no claim to that name beyond gratuitous conjecture. See *Proceedings of the Society of Antiquaries of Scotland*, vol. iii. part 2, pp. 179, 180.

GEEFS, Guillaume, a Belgian sculptor, was b. at Antwerp, Sept. 10, 1806. After studying there for some time, he went to Paris, where he worked in the studio of M. Ramey. During the revolution of 1830, he quitted Paris, and returned to Belgium, and soon after executed at Brussels a monument to the memory of the victims of the revolution of 1830. The most important of his other works are a "Colossal Marble Statue of King Leopold;" "Monument to Count Frederic de Merode," now in the cathedral of Brussels; and "Statue of Gen. Belliard," both of whom fell in the revolution. He executed a group entitled "Le Lion Amoureux," which was shown at the exhibition in Paris (1855). He died in 1860.—Geefs, Joseph, younger brother of the preceding, and born in 1808, has also acquired a reputation as a scpultor. He has executed a number of statues, of which two, "Metabus" and "Thierry Maertens," were shown at the exhibition in 1855. In general character, his works bear a considerable resemblance to those of his brother.—Geefs, Aloys, youngest brother of the preceding, is also known as a sculptor by means of his "Epaminondas Dying," "Beatrix," and the bas-reliefs for the "Rubens" of his eldest brother. He died in 1841.

GEEL, Jakob, a distinguished Dutch scholar, was b. at Amsterdam in 1789, and educated at the athenæum of that city, principally under Van Lennep. After living at the Hague from the year 1811 as a family tutor, he became second librarian at Leyden in 1823, and in 1833 head-librarian and honorary professor. He had made himself meanwhile known as a philologist by editions of Theocritus, with the *Scholia* (1820), of the *Anecdota Hemsterhusiana* (1826), of the *Scholia in Suetonium* of Ruhnken (1828), of the *Excerpta Vaticana* of Polybius (1829); and his *Historia Critica Sophistarum Græcorum* (1823) had called forth several treatises on the same subject from German philologists. In 1840, appeared his edition of the *Olympicus* of Dio Chrysostom, accompanied by a *Commentarius de Reliquis Dionis Orationibus;* and in 1846, he issued the *Phœnissæ* of Euripides, with a commentary, in opposition to Hermann. All these works, which are written in pure and pleasing Latin, are models of thorough scholarship, as well as of taste and method. Geel contributed further to the revival of classical learning in the Netherlands by the establishment, along with Bak, Peerlkamp, and Hamaker, of the *Bibliotheca Critica Nova*, in 1825. The national literature is also indebted to him not only for the translation of German and English works into Dutch, but also for original treatises on various æsthetical subjects. He won, moreover, the gratitude of the learned throughout Europe by his liberality as a librarian, and especially by his valuable *Catalogus Codicum Manuscriptorum, qui in de ab Anno* 1741 *Bibliothecæ Lugduni Batavorum accesserunt* (1852).

GEELONG', a flourishing city of Victoria, in Australia, in 30° 10' s. lat., and 144° 24' e. long., is picturesquely situated on the s. side of Corio bay, 45 m. s.w. of Melbourne. It is the terminus of the Victoria railway, and has telegraphic communication with Melbourne, Ballarat, and other places. The river Barwon forms the southern boundary of the city, and 3 m. farther spreads into the Connewarre lakes, falling into the sea at point Flinders. The discovery of gold-fields in the neighborhood in 1851, added to the prosperity of Geelong, which had become a principal seat of the wool trade. The first woolen mill in Victoria was erected in Geelong, and the government award of £1500 gained. Alongside of the railway jetty, which is 1000 ft. long, the largest ships can load and discharge, and there are three other jetties for the smaller vessels. Through the bar at the entrance to Corio bay, a channel has been dredged to a depth of 21 ft. 6 in.,

at a cost of £60,000. The district is exceedingly fertile, and the Barrabool hills on the w. bank of the Barwon are covered with farms, orchards, and vineyards. Limestone and a kind of marble are found in the neighborhood. There are various industries carried on, especially the manufacture of woolen cloths, meat-preserving, tanning, fishing, etc. The city is lighted with gas, and is supplied with water from the river, and has an excellent hospital, several asylums, a chamber of commerce, mechanics' institute, botanical garden, public park, grammar school, and newsdapers. Pop. within the corporate boundary, 12,500, and including the suburbs, 23,000.

GEER, GEORGE JARVIS, D.D., b. Conn., 1821; graduated at Trinity college and the New York general theological seminary; has been deacon, rector, and presbyter, and in 1852 was appointed rector of St. Timothy's church, New York. In 1858, with Dr. Muhlenberg and Dr. Bidell, he published the *Time Book of the Protestant Episcopal Church*, and subsequently *The Conversion of St. Paul.* He was the first president of the Free church Guild of New York, and in 1874 a member of the general convention.

GEESTERMUNDE, a seaport in the Prussian province of Hanover, in the district of Stade, situated at the mouth of the Geeste, a right-hand affluent of the estuary of the Weser. It lies about 32 m. n. of Bremen, and is the terminus of a railway from that city. The interest of the place is purely naval and commercial, its origin dating back no further than 1857, when the construction of the harbor was commenced. The great basin opened in 1863 has a length of 1785 English ft., and a breadth of 410, and a depth of nearly 23, and can accommodate 24 or 25 of the largest ships of the line; and the petroleum basin opened in 1874 has a length of 820 ft. and a breadth of 147. To the left of the basin lies a canal, which has a length of 13,380 ft. and a breadth of 155; and from this canal there strikes off another of similar proportions. The whole port is protected by powerful fortifications, and it lies outside the limit of the German customs. Since 1864, the trade has been almost trebled, the number of vessels being 617 sea-going ships entering in 1875 and upward of 2,000 river craft. Among the industrial establishments of the town are ship-building yards, foundries, engineering works, and steam mills. The population exclusive of the garrison, 8,436 in 1875; and if the neighboring commune of Geestendorf be included, the total was 10,425.

GEEZ. See ETHIOPIA, *ante.*

GEFFRARD, FABRE, son of Nicholas Geffrard, one of the founders of Haytian independence, b. Hayti, 1806. After graduating in 1821, he joined the 13th regiment as a private soldier, attaining the grade of captain in 1843, in which year he joined Hirard, in rebellion against Boyer. Having in 1845 been appointed general of division, he was in 1846 deprived of his command by president Riche, and tried by a court-martial. From 1849 to 1856 he was actively engaged in the army, and distinguished himself in the campaign of 1856, particularly in the retreat from San Juan. Finding that it was the intention of president Soulouque (Faustin I.) to arrest him, he proclaimed himself president, Dec. 21, 1858; drove Soulouque from Port-au-Prince, Jan. 15, 1859, and established himself as president. A rebellion raised by Salnave in 1864–65, was suppressed by president Geffrard. A further revolutionary movement, headed by Salnave, was begun in Feb., 1867, and was sufficiently successful to compel president Geffrard's abdication and flight to Jamaica, where he now resides with his family. He has been for many years extremely popular, and his administration of the government was attended with great success.

GEFLÉ, an important t. of Sweden, chief town of the læn Gefleborg, is situated at the mouth of the river Gefle, on an inlet of the gulf of Bothnia, about 100 m. n.n.w. of Stockholm. The stream upon which it stands is divided into three branches, forming two islands, which are united by bridges with the right and left banks of the river, and form portions of the town. Gefle ranks third among the commercial towns of Sweden; Stockholm and Göteborg alone possessing a more extensive trade. The chief buildings are a gymnasium; a castle, imposingly situated; a court-house, which is considered one of the finest in Sweden; a good public library, and an excellent harbor. Gefle carries on ship-building to some extent, and has manufactures of sail-cloth, linen, leather, tobacco, and sugar. Its exports are iron, timber, tar, flax, and linen; and its imports chiefly corn and salt. Pop. '74, 16,787.

GEHEN'NA is the Greek form of the Hebrew *Ge-hinnom* ("Valley of Hinnom"), or *Ge-ben-Hinnom* ("Valley of the Son of Hinnom"). This valley, or rather gorge—for it is described as very narrow, with steep and rocky sides—lies s. and w. of the city of Jerusalem. Here Solomon built a high place for Molech (1 Kings xi. 7), and, in fact, Gehenna would appear to have become a favorite spot with the later Jewish kings for the celebration of idolatrous rites. It was here that Ahaz and Manasseh made their children pass through the fire, "according to the abomination of the heathen;" and at its s.e. extremity, specifically designated Tophet ("place of burning"), the hideous practice of infant sacrifice to the fire-gods was not unknown (Jeremiah vii. 31). When king Josiah came forward as the restorer of the old and pure national faith, he "defiled" the Valley of Hinnom by covering it with human bones, and after this it appears to have become "the common cesspool of the city, into which its sewage was conducted, to be carried off by the waters of the Kidron, as well as a laystall, where all-

its solid filth was collected. Hence, it became a huge nest of insects, whose larvæ or 'worms' fattened on the corruption." It is also said that fires were kept constantly burning here, to consume the bodies of criminals, the carcasses of animals, and whatever other offal might be combustible. Among the later Jews, Gehenna and Tophet came to be regarded as symbols of hell and torment, and in this sense the former word is frequently employed by our Savior in the New Testament. For example, in Mark ix. 47, 48, he says: "It is better for thee to enter into the kingdom of God with one eye, than having two eyes, to be cast into hell-fire [Gehenna]; where their worm dieth not, and the fire is not quenched."

GEIBEL, Emanuel, one of the most popular of the living poets of Germany, was b. at Lübeck, on Oct. 18, 1815. After attendance at the high school of his native town, he completed his studies at the university of Bonn. In 1836, he went to Berlin, where he became acquainted with Chamisso, Gaudy, and Kugler. Two years afterwards he obtained a tutorship in the family of the Russian ambassador at Athens, where he still prosecuted his studies. On his return to Lübeck in 1840, he worked up the material he had collected in Greece, and became, in addition, a diligent student of Italian and Spanish literature. Soon after the publication of his first poems, a pension of 300 thalers a year was bestowed upon him by the king of Prussia. Geibel now resided alternately at St. Goar with Freiligrath, at Stuttgart, Hanover, Berlin, and Lübeck; till, in 1852, he was appointed professor of æsthetics in the university of Munich by the king of Bavaria. He remained in this post till 1868, when he retired to Lübeck. Along with Curtius, he published his *Classische Studien* (1840), containing translations from the Greek poets. These were followed in the same year by his *Gedichte* (82d edit. 1877), the beauty and religious tone of which made them at once great favorites with the Germans. The results of his Spanish studies were the *Spanischen Volkslieder und Romanzen* (Berlin, 1843), which were followed by the *Spanische Liederbuch* (Berlin, 1852), published in conjunction with Paul Heyse. In 1857 appeared his tragedy of *Brunehilde*, and in 1864 *Gedichte und Gedenkblätter*. In 1868 he published another tragedy called *Sophonisbe*. His poems are distinguished by fervor and truth of feeling, richness of fancy, and a certain pensive melancholy, and have procured him a popularity—especially among cultivated women—such as no poet of Germany has enjoyed since the days of Uhland.

GEIGER, Abraham, a Jewish scholar, was b. at Frankfort-on-the-Maine, May 24, 1810. According to old rabbinical practice, his teachers were his father and elder brother, till he reached the age of eleven. After that, having received a more regular education for some years, he went, in 1829, to the university of Heidelberg, and shortly afterwards to that of Bonn. While engaged there in the study of philosophy and of the Oriental languages, he gained a prize for an essay on the Jewish sources of the Koran, which at a later period appeared in print under the title, *Was hat Mohammed aus dem Judenthum aufgenommen?* (Bonn, 1833). In Nov., 1832, he was called as rabbi to Wiesbaden, and there, under the impulse to the scientific study of Judaism which proceeded from Berlin, he devoted himself zealously to Jewish theology, especially in its relation to practical life. In 1835, he joined with several able men in editing the *Zeitschrift für Jüdische Theologie*. The spirit of inquiry, however, with which he discussed prevalent opinions and usages, brought him into collision with the conservative Jews, especially after 1838, when he became assessor of the rabbinate at Breslau; but the great majority of educated men in the sect continued attached to him. It was he who gave the first impulse to the celebrated assemblies of the rabbis, three of which have been held since 1844 at Brunswick, Frankfort-on-the-Maine, and Breslau. At the second of these he was vice-president, and president at the third. Though Geiger thus took an active part in the reform movement, he could not abandon his historical point of view, which made him unwilling to break entirely with the past; and therefore he refused a call to be preacher to the Berlin reform society. Besides sermons, pamphlets, and numerous contributions to the above-mentioned periodical, Geiger published some historical monographs, which are distinguished by thoroughness of investigation and many-sided learning. Among these may be mentioned the *Melo Chofnajim* (Berlin, 1840), on Joseph Salomo del Medigo, and the *Nite Naamanim* (Berlin, 1847), on the exegetical school of northern France. His *Lehr- und Lesebuch zur Sprache der Mischna* (1845) also is of great value to the oriental philologist. In 1850 appeared the first number of *Studien* on Moses-Ben-Maimon; and in 1851, a translation of the *Divan of the Castilian Abu'l-Hassan Juda ha-Levi*, accompanied by a biography of the poet and explanatory remarks. Besides some specimens of Jewish mediæval apologetics and numerous articles in the reviews, Geiger published *Urschrift und Uebersetzungen der Bibel in ihrer Abhängigkeit von der inneren Entwickelung des Judenthums* (1857); *Das Judenthum und seine Geschichte* (1864–65); *Unser Gottes-dienst* (1868); *Israel. Gebetbuch;* etc. From 1863 to 1870, Geiger was rabbi in Frankfort; and thence until his death (Oct., 1874) in Berlin.

GEILER VON KAISERSBERG, Johann, a famous pulpit-orator of Germany, was b. at Schaffhausen, Mar. 16, 1455; studied at Freiburg and Basel, where he obtained his degree of D.D.; and in 1478 became preacher in the cathedral of Strasburg, where he died Mar. 10, 1510. Geiler ranks among the most learned and original men of his age. His sermons, usually composed in Latin and delivered in German, are marked by great

eloquence and earnestness; nor do they disdain the aids of wit, sarcasm, and ridicule. Vivid pictures of life, warmth of feeling, and a bold, even rough morality, are their leading characteristics. In fact, Geiler's ethical zeal often urged him to a pungency of satire hardly in keeping with modern views of the dignity of the pulpit, but quite congruous with the taste of his own age. His style is vigorous, free, and lively, and in many respects he may be regarded as a sort of predecessor of Abraham a Sancta-Clara. Of his writings, which have now become very rare, may be mentioned *Narrenschiff* (Lat. Strasb. 1511; Ger. by Pauli, 1520), comprising 412 sermons on Sebastian Brandt's (q.v.) *Narrenschiff; Das Irrig Schaff* (Strasb. 1510); *Der Seelen Paradiess* (Strasb. 1510): *Das Schiff der Pönitenz und Busswirkung* (Augsb. 1511); *Das Buch Granatapfel* (Strasb. 1511); *Christliche Pilgerschaft zum Ewigen Vaterland* (Basel, 1512); *Das Evangelienbuch* (Strasb. 1515); and *Das Buch Von Sünden des Mundes* (Strasb. 1518). Compare Ammon's *G. Von Kaisersberg's Leben, Lehren und Predigten* (Erl. 1826), and Meick's *Joh. G. Von Kaisersberg. Sein Leben und Seine Schriften in einer Auswahl* (3 vols., Fkf. 1829).

GEISSLER'S TUBES, glass tubes used in electrical experiments. They contain some kind of gas in a very rarefied state, which is called an oxygen vacuum, or a nitrogen vacuum, or a carbonic acid vacuum, etc. An electrode is introduced at each end of the tube, so that discharges or currents of electricity, from an induction coil, or from an ordinary statical machine, may be passed through them. The different gases afford different phenomena, according to circumstances. When the glass, which should be hard, is proportioned to the amount of "vacuum," or rarefaction, and also to the current, exquisitely beautiful effects can be produced. A carbonic acid vacuum tube, in the form of a small spiral, is capable of emitting an intense light, and has been proposed as a means of making physical diagnosis, by illuminating certain cavities in the body. They were invented by Heinrich Gessler, a talented practical physicist (Saxony, 1814–79), who was by trade a glass-blower. He afterwards studied physics, and has made several determinations of value in science, as the maximum density of water at 3.8 C., the coefficient of expansion for ice between certain temperatures, and at the freezing-point. He discovered, with Vogelsang, the existence of liquid carbon dioxide in cavities in quartz and topaz. He invented a mercury air-pump, which he used in exhausting his tubes, an areometer, and a vaporimeter. He received the honorary title of PH.D. from the university of Bonn.

GEJER, ERIC GUSTAF, one of the most distinguished historians of Sweden, was b. at Ransätter, in the Swedish læn of Wermland, in 1783. He was sent, at the age of 16, to the university of Upsala; and in 1803 he competed successfully for the prize which was that year awarded by the academy of Stockholm for the best essay on the life and character of the great Swedish administrator, Sten Sture. This was the turning-point of his life, for from this period he began to devote himself with zealous industry to the study of the history of his native country. His assiduity was rewarded by his speedy nomination to a post in the chamber of the national archives, and in 1810 he was elected assistant to Fant, the professor of history in the university of Upsala, and in 1817, on the death of the latter, he succeeded to his chair. Gejer's early lectures were listened to with the profoundest interest, both by his students and the public at large, who crowded to his lecture-room; but at a subsequent period of his teaching, his popularity diminished in proportion to the increased profundity of his views; while the suspicion that he harbored sceptical notions in regard to the Trinity, brought him into disfavor with a certain portion of the community. These suspicions led to his denunciation to the university authorities; but the examination to which the charges against him gave rise terminated in his acquittal, and were even followed by the offer of a bishopric, which, however, he declined. Gejer exercised a marked influence on the poetic no less than the historical literature of Sweden, and according to the testimony of his countrymen, his *Sista Skalden*, *Vikingen*, *Odalbonden*, and other heroic pieces, place him in the foremost rank of Swedish poets. He and his friends Adlerbeth, Tegner, and Nikander, adhered to the "Gothic" school of poetry, which owed its origin to "the society of the Goths," which they and several of their friends established as early as 1810, when they brought out in connection with it a magazine entitled the *Iduna*, in which first appeared several of Gejer's best poems, and among other productions of merit, the early cantos of Tegner's *Frithiof*. Great as is the value of Gejer's historical works, he unfortunately did not complete any one of the vast undertakings which he planned. Thus, for instance, of the *Svea Rike's Häfder*, or records of Sweden, which were to have embraced the history of his native country from mythical ages to the present time, he finished only the introductory volume. His next great work, *Svenska Folkets Historia*, which was intended to form one of the series of European histories, edited by Leo and Uckert, was not carried beyond the death of queen Christina; yet incomplete as they are, these works rank among the most valuable contributions to Swedish history. To Gejer was intrusted the task of examining and editing the papers which Gustavus III. had bequeathed to the university of Upsala, with the stipulation that they were not to be opened for 50 years after his death. In fulfillment of his charge, Gejer arranged these papers in a work, which appeared in 1843 under the title of *Gustaf III.'s efterlemnada Papper*, and which, from the worthless nature of the contents, disappointed the expectations of the nation, who had been led to hope that their

publication would reveal state secrets of importance. During the last 10 years of his life, Gejer took an active part in politics; but although his political writings possess great merit, the very versatility of his powers diverted him from applying them methodically to the complete elaboration of any one great object. Gejer was known to his countrymen as a musician and composer of no mean order. He lived on terms of friendly intercourse with Bernadotte, and his numerous letters to the king form part of the *Samlade Skrifter*, or collective works, which have been published since his death by his son, who has appended to this edition, which was completed in 1853, an interesting biographical sketch of his distinguished father. Gejer died in 1847.

GELA, in ancient times, a very important town, on the southern coast of Sicily, on the river of the same name. It was founded by a Rhodian and Cretan colony, 690 B.C. Its rapid prosperity may be inferred from the circumstance, that as early as the year 582 B.C., Agrigentum was founded by a colony from Gela. After Cleander had made himself tyrant in the year 505 B.C., the colony reached its highest pitch of power under his brother Hippocrates, who subdued almost the whole of Sicily, with the exception of Syracuse. Gelon, the successor of Hippocrates, pursued the same career of conquest, and Syracuse itself fell into his hands, and was even made his principal residence, Gela being committed to the government of his brother Hiero. Here Æschylus, after having been honorably received by Hiero, died and was buried, 456 B.C. During the Carthaginian wars it suffered greatly, but its ruin was completed by Phintias of Agrigentum, who, before 280 B.C., removed the inhabitants to a town in the neighborhood, which he had founded, and named after himself. Its site is believed to be occupied by Terra Nova, at the mouth of the river Fiume di Terranova.

GELASIUS I. succeeded Felix III. in 492 as pope, and confirmed the estrangement between the eastern and western churches by insisting on the removal of the name of Acacius, bishop of Constantinople, from the diptychs. He was also the first decidedly to assert the supremacy of the papal over the general councils. He is the author of *De Duabus in Christo Naturis adversus Eutychen et Nestorium*. Five of his letters have also come down to us, and he is most probably the author of *Liber Sacramentorum*, published at Rome in 1680; but the so-called *Decretum Gelasii de Libris Recipiendis et Non Recipiendis* is evidently a forgery. Gelasius died in 496, and was canonized, his day being Nov. 18.

GELASIUS II. (Giovanni da Gaeta), of noble descent, b. at Gaeta about 1050. He received his theological education in the abbey of Monte Casino, and afterwards held the office of chancellor under Urban II., and of cardinal-deacon under Pascal II. On the death of Pascal II., he was elected pope by the cardinals, Jan. 18, 1118, and when his person was seized by Cencius Frangipani, a partisan of the emperor Henry V., he was almost set at liberty, through the general uprising of the people in his behalf. The sudden appearance of the emperor, however, compelled him to leave Rome for Gaeta, and the imperial party chose an anti-pope, Burdinus, archbishop of Braga, under the name of Gregory VIII. Gelasius held a council at Capua, and excommunicated his rival and the emperor. Returning to Rome, under the protection of the Norman princes, he lay concealed for a while, narrowly escaping capture once by the Frangipani, and, after wandering through Italy and France, died at Cluny.

GELATIG'ENOUS TISSUES AND GEL'ATINE. The gelatigenous tissues are substances resembling the proteine-bodies (albumen, fibrine, and caseine) in containing carbon, hydrogen, nitrogen, oxygen, and sulphur; but differing from them in containing more nitrogen and less carbon and sulphur. They consist of two principal varieties, viz., those which yield gluten (or ordinary *gelatine*) and those which yield *chondrine*.

Gluten is obtained by more or less prolonged boiling with water, from the organic matter of bone (the *osseine* of Frémy), from tendons, skin, cellular tissue, white fibrous tissue, the air-bladder and scales of fishes, calves' feet, hartshorn, etc.; while chondrine is similarly obtained from the permanent cartilages, from bone-cartilage before ossification, from enchondromatous tumors, etc.

Neither gluten nor chondrine appears to exist *as such* in the animal body, but is in all cases the result of the prolonged action of boiling water on the above-named tissues. Frémy's analyses (see his *Recherches Chimiques sur les Os*, in the *Ann. de Chim. et de Phys.*, 1855, vol. xliii., p. 51) show that osseine is isomeric with the gluten which it yields, and further, that the amount of gluten is precisely the same as that of the osseine which yields it.

The following table exhibits the composition of osseine and the gluten yielded by it as determined by Frémy, and that of chondrine as determined by Mulder:

	Osseine.	Gluten.	Chondrine.
Carbon	49.21	50.40	49.97
Hydrogen	6.50	6.50	6.63
Nitrogen	17.86	17.50	14.14
Oxygen with a little sulphur	25.14	26.00	28.97

Gluten, when perfectly pure and dry, is a tough, translucent, nearly colorless substance, devoid of odor and taste. It swells when placed in cold water, and loses its translucency; but in boiling water it dissolves, and forms a viscid fluid, which on cool-

ing forms a jelly. A watery solution containing only 1 per cent of gluten, gelatinizes on cooling. This property is destroyed both by very prolonged boiling and by the action of concentrated acetic acid. Gluten is insoluble in alcohol and in ether.

A solution of gluten is abundantly precipitated by solutions of corrosive sublimate and of bichloride of platinum, as well as by infusion of galls, of which the active principle is tannin or tannic acid (the terms being synonymous). Tannic acid produces, even in very dilute solutions, a copious yellow or buff-colored precipitate of tannate of gluten. The gelatigenous tissues unite in a similar manner with tannin; they extract it from its watery solutions, and form compounds with it which resist the action of putrefaction. It is thus that hides are converted into leather (q.v.). The tests which we have mentioned also precipitate albumen, but gluten may be distinguished from albumen by its not being thrown down (as is the case with albumen) by the addition of ferro cyanide of potassium together with a little acetic acid. The gelatinizing property also serves to distinguish gluten when it amounts to 1 per cent or more of the solution.

On exposure to the atmosphere, gluten becomes more rapidly putrid than almost any other animal substance. Under the influence of oxidizing agents, it yields the same products as the proteine-bodies; treated with the mineral acids or with alkalies, it yields glycocine (q.v.)—known also as glycine, glycocoll, and sugar of gelatine—leucine (q.v.), and other products.

Isinglass, which is prepared from the air-bladder of the sturgeon, etc., when boiled with water, furnishes gluten in a nearly pure state. Glue and size are two well-known forms of impure gluten or gelatine.

Chondrine resembles gluten in its physical properties, and especially in its property of gelatinizing. It differs, however, slightly from it in chemical composition (see the above table), and in its behavior towards reagents. For instance, acetic acid, alum, and the ordinary metallic salts of silver, copper, lead, etc., which produce no apparent effect on a solution of gluten, throw down a precipitate from a solution of chondrine; while, on the other hand, corrosive sublimate, which precipitates gluten freely, merely induces a turbidity in a solution of chondrine.

We do not know much regarding the physiological relations of these substances. Gluten (according to Scherer) usually exists in the juice of the spleen, but in no other part of the healthy animal body; it is sometimes found in the blood in cases of leucocythæmia, in pus, and in the expressed juice of cancerous tumors. Chondrine has been found in pus. The gelatigenous tissues rank low in the scale of organization, and their uses are almost entirely of a physical character. Thus they form strong points of connection for muscles (the tendons), they moderate shocks by their elasticity (the cartilages), they protect the body from rapid changes of temperature by their bad conducting power (the skin), and they are of service through their transparency (the cornea).

GEL'ATINE, in technology. This term, although usually applied to only one variety of the substance, obtained by dissolving the soluble portion of the gelatinous tissues of animals, nevertheless properly belongs also to ISINGLASS and GLUE, which are modifications of the same material. Vegetable jelly is also analogous, and will be mentioned under this head.

Gelatine and glue signify the more or less pure and carefully prepared jelly of mammalian animals, but the term isinglass is only applied to certain gelatinous parts of fishes, which from their exceeding richness in gelatine, are usually merely dried and used without any other preparation than that of minute division for the purpose of facilitating their action.

GELATINE (proper) is prepared for commercial purposes from a variety of animal substances, but chiefly from the softer parts of the hides of oxen and calves and the skins of sheep, such as the thin portion which covers the belly, the ears, etc.; also from bones and other parts of animals.

One of the best, if not the best of the varieties of gelatine manufactured in Great Britain, is that made by Messrs. Cox of Gorgie, near Edinburgh, which is remarkable for its great purity and strength, or gelatinizing power; they call it "sparkling" gelatine from its beautiful bright transparency, and its purification is effected by certain processes which they have patented. The materials they use are carefully selected portions of ox and calf hides. Another preparation, made by Mr. Mackay of Edinburgh (pharmaceutical chemist), is deserving of special mention, as it is prepared with the greatest care from calves'-feet, and is especially adapted for invalids. It is made on a limited scale, and only for a few leading chemists.

The general method adopted with skin-parings or hide-clippings, is first to wash the pieces very carefully; they are then cut into small pieces and placed in a weak solution of caustic soda for a week or ten days, the solution being kept moderately warm by means of steam-pipes. When this process of digestion has been sufficiently carried on, the pieces of skin are then removed into an air-tight chamber lined with cement, and here they are kept for a time, determined according to the skill of the manufacturer and the kind of material employed, at a temperature of 70° F. They are next transferred to revolving cylinders supplied with an abundance of clean cold water, and afterwards are placed still wet in another chamber lined with wood, in which they are bleached and purified by exposure to the fumes of burning sulphur; they next receive their final washing with cold water, which removes the sulphurous acid. The next

operation is to squeeze them as dry as possible, and transfer them to the gelatinizing pots, which are large earthen vessels, inclosed in wooden cases, made steam-tight. Water is poured in with the pieces, and kept at a high temperature by means of the steam in the cases surrounding the pots.

By this means the gelatine is quite dissolved out of the skin, and is strained off whilst still hot: it is poured out in thin layers, which as soon as they are sufficiently cooled and consolidated, are cut into small plates, usually oblong, and laid on nets, stretched horizontally, to dry. The cross-markings observable on the plates of gelatine, in the shops, are the marks left by the meshes of the nets.

Another process, introduced by Mr. Swineburne, consists in treating pieces of calf-skin by water alone, without the soda and sulphur processes; the pieces, after simple washing, being transferred at once to the pots to be acted upon by the steam; undoubtedly, this is the purest, but the expense of preparing it prevents its general use. Inferior gelatine is made from bones and other parts of animals, and it was stated by an eminent authority, that in Paris the enormous number of rats which are occasionally killed in the sewers and abattoirs, after being deprived of their skins, which are reserved for other purposes, are all used by the gelatine-makers. These materials are placed in cages of wire, which are placed in steam-tight boxes, where they are submitted to the direct action of steam of 223° F., but at a low pressure: and cold water, supplied by another pipe through the upper part of the box, is allowed to flow slowly and percolate through the contents of the cage, the water and condensed steam descend to the bottom charged with gelatine, and are drawn off by a stop-cock placed there for the purpose.

The French manufacturers succeed better than any others in clarifying these inferior gelatines, and they rarely make any others; they run their plates out very thin, which gives them greater transparency and apparent freedom from color; and they color them with most brilliant colors, and form very fine-rolled sheets, tempting the eye with an appearance of great delicacy and purity, which would at once disappear if the material were made up into the thicker plates of the British manufacturers.

The purity of gelatine may be very easily tested; thus: pour upon dry gelatine a small quantity of boiling water, if pure it will form a thickish gluey colorless solution, free from smell; but if made of impure materials, it will give off a very offensive odor, and have a yellow gluey consistency. No article manufactured requires such careful selection of material and such nice and cleanly manipulation to insure a good marketable character; and those anxious for purity should avoid all artificially colored varieties, however temptingly got up, unless they are required for merely decorative purposes and not for food. For the value of gelatine as food, see DIET.

ISINGLASS (supposed to be derived from the German *Hausenblase*, bladder of the sturgeon), the *ichthyocolla* (*ichthus*, a fish; *kolla*, glue) of the classical and scientific writers, was formerly obtained only from the common sturgeon (*accipenser sturio*), and consisted of the dried air-bladder of the animal. The necessities of modern commerce have, however, led to the discovery, that the same part in many other fishes forms good isinglass; and instead of Russia, as formerly, being almost the only producing country, we have now large quantities from South America, chiefly imported from Maranham, some from the East Indies, the Hudson's Bay Territory, New York, and, owing to prof. Owen calling the attention of the Canadian commissioners of the exhibition of 1851 to the subject, it is now brought in considerable quantities and of excellent quality from Canada, where it is likely to prove a source of profitable industry.

The commercial varieties of this material are numerous, and a thorough knowledge of them can only be obtained by considerable personal acquaintance with them; therefore, their names only are given, with those of the producing animals:

RUSSIA—

Long Staple Ural,*	1st quality.	Accipenser Guldenstadtii.
" " "	2d "	
Short Staple Patriarch.		
Book Patriarch	1st "	
" "	2d "	
Thin leaf Patriarch	1st "	
" " "	2d "	
Belugo	1st "	Accipenser Huso.
"	2d "	
The brown soiled and ragged ends called *Pickings*.		
Sisane, leaf	?	
Kroski, or Krosky	?	
Samovey, leaf	1st quality.	Silurus Glanis (?)
" "	2d "	
" staple		
" book	1st "	
" "	2d "	
Siberian, Purse		Accipenser Sturio (?)

* So called from the bladder being purposely bent into the form of a *staple* in drying.

South America—

Brazilian, Pipe	Probably a species of Pimelodus.
" Lamp	Probably a species of Silurus.
" Honey-comb	

East Indies—

East Indian, Purse	Probably a species of Polynemus.
" " Leaf	

North America—

Hudson's Bay, Purse	Accipenser.
New York, Ribbon	Gadus Merluccius.
Canadian, leaf	Accipenser Sturio.

Besides these now well-known commercial varieties, others are occasionally met with, as the *Manilla*, in thin cakes; the *Para*, which is the most remarkable of all, resembling grapes of a reddish-brown color, growing from a straight thick stem; these are the dried ova of the *sudis gigas*, a large fish common in the mouths of the Amazon. An inferior kind is also made of cod-sounds and sole-skins, sufficiently good, however, to be used in fining beer and other liquids.

One of the qualities of gelatine is its power to form chemical combinations with certain organic matters; hence, when it is mixed and dissolved in a fluid containing such matters, it combines, and the compound is precipitated. It would appear that this combination, however, is thread-like in its arrangement, and that the crossing threads form a fine net-work through the fluid, which, in falling, carries down all floating substances, which, by their presence, render the liquid cloudy; hence its great value in clarifying beer and other liquids. For this reason isinglass, which has been found the best gelatine for the purpose, is very largely consumed by brewers.

Isinglass, strictly speaking, is not gelatine, but its only value is from the excessive proportion of gelatine held in the tissues of the organ which yields it, greatly enhanced by the ease with which it is abstracted from the membrane when compared with the complicated process necessary for separating and purifying the gelatine from the skins, etc., of other animals. When separated, however, the substances are identical in composition, and, if pure, are undistinguishable from each other.

Besides the substances mentioned as yielding gelatine, formerly hartshorn shavings were used, and ivory turnings and saw-dust are still employed, both, however, chiefly for dietetic purposes for invalids; and various kinds of animal food are valued for the abundance of gelatine they contain, as the trepang and beche de mer (species of holothuria), sharks' fins, fish-maws, ray-skins, elephant hide, rhinoceros hide, and the softer parts, all of which are luxuries amongst the Chinese, Japanese, Siamese, Malays, etc. Turtle-shells, or the upper and lower parts of the shield (*carapace* and *plastron*), constitute the callipash and callipee of the epicure, and form, in the hands of the experienced cook, a rich gelatinous soup. The fleshy parts of the turtle, calves' head and feet, and many other things, might be enumerated as valuable, chiefly in consequence of their richness in this material.

Glue differs only from *gelatine* in the care taken in its manufacture, and in the selection of the materials from which it is made; almost every animal substance will yield it, hence all kinds of animal refuse find their way to the glue-makers' boilers. Nevertheless, the impossibility of preserving, for any length of time, the materials required for this manufacture, renders it necessary to adopt some system in choosing and preserving them, until sufficient quantities are collected, without fermentation or decomposition. Hence the refuse of tanneries, consisting of the clippings of hides, hoofs, ear and tail pieces of ox, calf, and sheep, are preferred, because they can be dressed with lime, which removes the hair, and acts as an antiseptic. For this purpose they are placed in tanks with quicklime and water for two or three weeks, during which the lime is several times renewed, and the pieces frequently turned over. They are afterwards washed and dried, and are ready for use by the glue-maker, who usually gives them another slight lime-dressing, and subsequently washes them; they are afterwards exposed to the action of the air for a time, to neutralize the caustic lime. When well-drained, the pieces are placed in flat-bottomed copper-boilers, which have a perforated false bottom placed a little distance above the true one, to prevent the burning of the materials, and which have been supplied with rain or other soft water up to two thirds the depth of the boiler, the pieces being piled up to some height above the top of the open boiler. The whole is kept at a gentle boiling heat until all the gelatinous part has dissolved out, and the mass of material has sunk down into the fluid. The boiling is sustained until, by repeated trials of small quantities, the operator knows the fluid is of the right consistency, when it is drawn off carefully into the congealing boxes, and fresh materials are added to the residue left behind in the boiler, and the process is repeated.

The congealing boxes are of wood, and are nearly square, being slightly narrower at the bottom than the top; they are filled to the brim, and when their contents are sufficiently solidified, the glue, with a little management, turns out in the form of a cube, which is cut into thin slices by a wire in the same manner as soap; and these larger slices are subdivided into smaller cakes by a wet knife. Frames, with nets stretched

upon them, are provided for drying the cakes upon; and these frames, when covered with the cakes of glue, are adjusted one over another at a little distance apart, supported between four uprights, and if in the open air, covered over with little wooden roofs, the whole being arranged so that the air can have free access to facilitate drying. This process is an anxious one to the manufacturer, as the changes of the weather have great and often completely destructive effects upon glue in this state; and in this country only the spring and the autumn can be relied upon with any satisfaction. Generally, after the open-air drying, the glue is taken to drying-rooms heated slightly, where it hardens effectually; but it is not yet finished; the cakes at this stage have a dull, unsightly look, to remedy which they are dipped into cold water, or are wetted with a brush dipped in hot water, and redried, this wetting giving the cakes a bright varnished appearance. Great Britain does not excel in the manufacture of glue, and British workmen usually prefer the dark variety. Very superior glue is made by the Dutch and Germans, by whom the light and more carefully made varieties are most prized, the adhesive qualities being lessened exactly in proportion to the impurities present in the material.

Besides its use in joinery, cabinet-making, and similar operations, glue is used by paper-makers and in dressing silks; and for these last two purposes fine light-colored kinds in thin cakes are made. Large quantities are employed also by paper-hangers and others for sizing walls in the state called *size*, which is the glue simply gelatinized after boiling in the first process. A very fine and pure white *size* is made by the bonnet-makers of Bedfordshire and other places of the skins of calves' head, ears, and the under part of the neck and belly: this is used for stiffening straw, cotton, horse-hair, and other plaits for making bonnets and hats.

VEGETABLE JELLY, which is analogous to animal gelatine, is obtained largely from some fruits, but never in a pure state; it is only of value in preserving such parts of the fruit for culinary purposes; but several of the sea-weeds yield a large quantity of very pure jelly, which, in some instances, is applied to important purposes: thus, the jelly of *fucus spinosus*, the agar-agar, or agal-agal, abundant on the shores of the eastern seas, is used by the East Indians, Cingalese, and Chinese for dressing their silks; the Chinese also ingeniously form thin films of the jelly over a framework of bamboo, and thus make small windows for their houses. This, and another, *gracillaria lichenoïdes*, are formed into a thick jelly, with sugar and other materials, and eaten as a delicacy; and both are supposed to supply the material for those wonderful birds'-nests, which constitute the most costly luxury known to the art of cooking. Another jelly-yielding sea-weed is found on our own shores, called Irish moss or carrageen (q.v.), which is often made into jellies for invalids, and the plant itself, on account of its richness in this material, is very extensively employed in feeding cattle, especially in England.

GELDERLAND, a province of the Netherlands, is situated between the Zuider Zee on the n.w., and the Prussian dominions on the s.e. It has an area of 1948 sq.m. and in 1875 a pop. of 445,480. It is watered chiefly by the Yssel, the Rhine, and the Waal. The surface is undulating, and northward from Arnheim, the capital, are beautiful well-wooded districts; in the n.w., sandy ground, heath, and extensive tracts of oak copsewood, grown for bark and fire-wood. The climate is healthy, and the soil, on the whole, good, though much of it is still uncultivated sand and marsh. Along the river valleys a rich loamy soil is found. Agriculture is prosecuted with great success. Wheat, rye, buckwheat, tobacco, fruit, etc., are extensively grown. Among the manufactures, paper and leather are the principal. Chief towns—Arnheim, Nimeguen, and Zutphen.

GELDERN, a t. in Prussia, 17 m. s.w. of Wesel by rail, situated on the river Niers; pop. 5,196. Its business is chiefly the manufacture of woolen cloths, hats, stockings, silk, and linen. It was built in 1097, and was for 250 years the seat of the dukes of Geldern. Frederick the great destroyed the fortifications in 1764.

GELEE, CLAUDE. See CLAUDE LORRAINE, *ante*.

GELID'IUM, a genus of *algæ* (sea-weeds), of the sub-order *ceramiaceæ*, some of the species of which are believed to afford the material used by certain species of swallow in building the edible nests so much prized by the Chinese. See NESTS, EDIBLE. Several species of gelidium are used as food in the east. Like many other sea-weeds of this order, they are almost entirely gelatinous, and when boiled with condiments to give pungency and flavor, form a very wholesome and agreeable food.

GELL, Sir WILLIAM, Knight, an eminent antiquarian and classical scholar, the younger son of Philip Gell, esq., of Hopton, Derbyshire, was born in 1777. He was educated at Jesus college, Cambridge, where he graduated as B.A. in 1798, and M.A. in 1804, and was for some time a fellow of Emmanuel college in that university. He devoted his time principally to antiquarian research and geographical studies, and published the following learned and valuable works: *The Topography of Troy* (1804, folio); *The Geography and Antiquities of Ithaca* (1808, 4to); *The Itinerary of Greece* (1810, 4to); *The Itinerary of the Morea* (1817, 8vo); *Attica* (1817, folio); *Pompeiiana, or Observations upon the Topography, Edifices, and Ornaments of Pompeii*—in conjunction with J. P. Gandy, esq.—an interesting and beautiful work, which first brought his name into notice (2 vols. 8vo, 1817–19; second series, 2 vols. 8vo, 1832); *Narrative of a Journey in the Morea* (1823,

8vo); *The Topography of Rome and its Vicinity* (1834, 8vo); *Rome and its Environs* (map, 1834). In Aug., 1814, on the departure to the continent of Caroline, princess of Wales, consort of George IV., she appointed him as one of her chamberlains. In that capacity he attended her in various parts of Italy, but being attacked with the gout, was soon obliged to resign his situation. In 1820, he was examined as a witness at the bar of the house of lords during the proceedings against her majesty after she became queen, and had returned to England. Subsequently, he resided in Italy, principally at Naples, having a house also at Rome, where he occasionally took up his abode. He died at Naples, Feb. 4, 1836, and was interred in the English burial-ground of that city.

GEL'LERT, CHRISTIAN FÜRCHTEGOTT, a German poet and moralist, was born July 4, 1715, at Haynichen, in the Erzgebirge, in Saxony, entered the university of Leipsic in 1734, where he devoted himself mainly to the study of theology. After some years spent as a tutor, and as a teacher in a public academy, he obtained a professorship in the same university in 1751. His lectures on poetry, rhetoric, and morals were numerously attended, and were greatly admired. He died Dec. 13, 1769. Gellert was a man of spotless virtue, but rather effeminate in mind and character. He wrote fables, stories, didactic poems, spiritual odes and songs. His most popular writings were his fables and stories. They are marked by ease and naturalness of manner. His spiritual odes owe their continued popularity to their deep piety, and to a certain vigor and loftiness of flight not to be found in his other poems. Gellert is to be considered one of the pioneers of modern German literature. He marks, along with others, the transition from the dullness and pedantry of the previous generation of authors, to that rich and superabundant life which Goethe and Schiller poured into the national literature. Gellert's collective works (*Sämmtliche Werke*) first appeared at Leipsic in 10 vols. (1769–74), and have passed through various editions; the most recent is that published in Berlin, (10 vols., 1867). Compare *Gellert's Leben,* by J. A. Cramer (Leip. 1774), and by Döring, (2 vols., Leip. 1833); also *Gellert's Tagebuch* (2d ed., Leip. 1863).

GELLIUS, AULUS, a Latin author, who seems to have lived about 117–180 A.D. The exact date, either of his birth or death, is not known. He is supposed to have been born at Rome, where, at all events, he studied rhetoric. Subsequently, he proceeded to Athens to undergo a discipline in philosophy. On his return to Rome, he entered upon a legal career, without, however, abandoning his literary pursuits. Gellius's well-known work, the Attic Nights (*Noctes Atticæ*), begun during the long nights of winter in a country-house near Athens, and completed during the latter years of his life, is a collection of miscellaneous matter on language, antiquities, history, and literature, in 20 books, of which the 8th is wanting. It contains many extracts from Greek and Latin authors no longer extant. The work is destitute of any plan or arrangement, is disfigured by archaisms, and derives its value mainly from being a repertory of curious knowledge. The *Editio Princeps* appeared at Rome in 1469; the earliest critical edition is that of Gronovius (Lug. Bat. 1706); the most important edition is that of Hertz (2 vols., Leip. 1853). Gellius has been translated into English by Beloe (Lond. 1795); into French by the Abbé de Verteuil (Paris, 1776); and (in part) into German by Von Walterstern (1785), also by Weiss (Leip. 1875–76).

GELON, "tyrant" of Gela and Syracuse, was the son of Deinomenes, and was a native of the former city. His family was one of the oldest and most distinguished in the place. Gelon himself first figures in history as one of the body-guards in the service of Hippocrates, tyrant of Gela. On the death of the latter, he contrived to obtain the supreme power (491 B.C.), and about 485 B.C., he made himself master of Syracuse also, which then became the seat of his government, and to which he transferred the majority of the inhabitants of Gela. His influence soon extended itself over the half of Sicily. Gelon refused to aid the Greeks against Xerxes, as they declined to comply with his demand that he should be appointed commander-in-chief. About the same time, Terillus, ruler of Himera, in Sicily, invoked the aid of the Carthaginians against Theron of Agrigentum, who had dispossessed him of his state. Gelon, who was in alliance with Theron, hastened to the assistance of the latter, and on the same day (according to tradition) on which the Greeks won the battle of Salamis, he gained a complete victory over the invaders at Himera. The consequence was an immediate treaty of peace between him and the Carthaginians, who were compelled to pay all the expenses of the war. His clemency and the wisdom of his measures rendered him so generally beloved, that when he appeared unarmed in an assembly of the people, and declared himself ready to resign his power, he was unanimously hailed as the deliverer and sovereign of Syracuse. The story current in later times, that one of the conditions on which he granted peace to the Carthaginians was, that their human sacrifices should be abolished, has probably no historical foundation, but it illustrates the general belief in the humanity of his character. Gelon died 478 B.C. The people, who, contrary to his desire, had erected a splendid monument to his memory, paid him honors as a hero, and at a later period, when all the brazen statues were sold under Timoleon, his statue was made an exception to the general rule. He was succeeded by his brother Hiero.

GELSEMIUM, a drug consisting of the root of *gelsemium sempervirens*, a climbing shrub of the natural order *Loganiaceæ*, having a milky juice, opposite, lanceolate, shining leaves, and axillary clusters of from one to five large, funnel-shaped, very fragrant

yellow flowers, whose perfume has been compared to that of the wall-flower. The fruit is composed of two separable jointed follicles, containing numerous flat-winged seeds. The stem often runs underground for a considerable distance, and indiscriminately with the root it is used in medicine. The plant is a native of the United States, growing on rich clay soil by the side of streams near the coast, from Virginia to the s. of Florida. In the United States it is commonly known as the wild, yellow, or Carolina jessamine, although in no way related to the true jessamines, which belong to the oleaceæ. It was first described in 1640 by John Parkinson, who grew it in his garden from seed sent by Tradescant from Virginia; at the present time it is but rarely seen, even in botanical gardens, in Great Britain. The medicinal properties of the root were discovered by accident, the infusion having been administered instead of that of some other root, with the result of curing the fever for which it was taken. It was then experimented upon by the American eclectic practitioners. In 1852, prof. W. Proctor called the attention of the medical profession to its valuable properties; and in 1864, it was placed on approval in the secondary list, and in 1873, so rapidly had it risen in favor, in the primary list of remedies of acknowledged value in the United States pharmacopœia. It has latterly attracted considerable attention in England as a remedy for certain forms of facial neuralgia, especially those arising from decayed teeth, or involving branches of the fifth nerve. In the United States it is more particularly valued for controlling nervous irritability in fevers of a malarial type, in which it is said to excel every other known agent. The physiological action of the drug has been carefully examined by Batholow, Ott, and Ringer and Murrell, from whose investigations it appears that it has a paralyzing action on the motor centers, affecting successively the third, fifth, and sixth nerves, its fatal action being due to its causing paralysis of the respiratory muscles, and thus producing death by asphyxia. In large doses it produces alarming symptoms, which occasionally terminate fatally. These appear to vary in different cases, but the more prominent are pain in the forehead and in the eyeballs, giddiness, ptosis, a feeling of lightness in the tongue, slurred pronunciation, labored respiration, wide dilation of the pupils, and impossibility of keeping an erect posture. The mind in most cases remains clear until shortly before death. The earliest and most prominent symptom of a fatal or dangerous dose is the drooping of the eyelids, which indicates the immediate administration of stimulants, for when the paralysis of the tongue which ensues extends to the epiglottis, deglutition becomes impossible, and the epiglottis is apt, unless the sufferer be placed in a forward position, to flap back and close the windpipe. The antidotes which have been found most successful are carbonate of ammonia, brandy, aromatic spirits of ammonia, and morphia. It has been found that death may be averted by keeping up artificial respiration until the poison is eliminated by the kidneys. [*Encyc. Brit.*, 9th ed.]

GEM, a term often used to signify a precious stone of small size, such as may be used for setting in a ring, or for any similar purpose of ornament; but sometimes by mineralogists in a sense which they have themselves arbitrarily affixed to it, for the purpose of scientific classification, as the designation of an *order* or *family* of minerals, generally hard enough to scratch quartz, insoluble in acids, infusible before the blow-pipe, without metallic luster, but mostly brilliant and beautiful. Among them are included some of the minerals which, in popular language, are most generally known as gems—ruby, sapphire, spinel, topaz, beryl, emerald, tourmaline, hyacinth, zircon, etc.—and some other rarer minerals of similar character; but along with these are ranked minerals, often coarser varieties of the same species, which are not *gems* in the ordinary sense of the word, as emery and common corundum, whilst diamond and some other precious stones, much used as gems, are excluded. See GEMS.

GEMA'RA (Ghemára, a Chaldee word, signifying complement) is that portion of the two Talmuds which contains the annotations, discussions, and amplifications of the Mishnah by the academics of Palestine on the one hand, and those of Babylon on the other. The Babylonian Gemára, more complete as well as more lucid than the Palestinensian, possesses a much more highly valued authority. The final redaction of this latter falls in the middle of the 4th c. A.D., while the former was not completed till 500 A.D. See MISHNAH and TALMUD.

GEMINI (the Twins), the third constellation of the zodiac, named from its two brightest stars, Castor, of the first magnitude, and Pollux, of the second.

GEMISTUS, GIORGIOS, called GIORGIOS PLETHON, and more commonly GEMISTUS PLETHON, was the last of the Byzantine writers. The exact dates of his birth and death are uncertain, but he is known to have lived between 1350 and 1450. He was probably born at Constantinople, but the greater part of his life was passed in the Peloponnesus. He was one of the deputies sent by the Greek church to the council which was held at Florence in 1438, for the purpose of arranging a union between the Latin and Greek churches. The council, however, entirely failed in its purpose. Gemistus was more celebrated as a philosopher than as a theologian. In his time, the Aristotelian philosophy reigned supreme, but it had degenerated into a mere science of words, from the study of which Gemistus turned away disgusted, and applied himself to Plato. Plato's philosophy so charmed him, that thenceforward he devoted himself to its propagation; and in furtherance of this view, Gemistus, when in Italy, induced Cosmo de Medici to embrace it. Cosmo's example was followed by others in Florence, and thus a Platonic

school was founded in the west which flourished for nearly 100 years afterwards. During the latter part of his life, Gemistus was engaged in bitter conflict with the most eminent of the Aristotelians, among whom George of Trebizond held a high position, and between him and Gemistus the discussion was carried on with most unseemly violence. Gemistus is last heard of in history in 1441, when we find him in the Peloponnesus in an official capacity. Gemistus wrote a great number of works in history, philosophy, theology, etc.

GEMMA'TION, or GEMMIPAROUS GENERATION. See REPRODUCTION.

GEMO'NA, a t. of Venetia, 15 m. n. by w. from Udine, on a feeder of the Tagliamento. It lies in a deep basin among mountains, and is a well-built town, surrounded by walls. Gemona has a large transit trade, and two important annual fairs. Pop. 6,634.

GEMO'TE. Besides the great council of the nation—the *witena-gemot*, or, as we more usually spell it, witenagemót (q.v.)—which corresponded to the reichstage of the Franks, and which, though it took the place of the still more ancient meetings of the whole nation, to which Tacitus refers as characteristic institutions of the Teutonic tribes in his day, was a representative, though not perhaps an elective body (Kemble's *Saxons in England*, ii. p. 194), there were amongst the Anglo-Saxons various minor motes or moots, which did not partake of the representative character. The existence of these is an instance of the manner in which the spirit of localization has always maintained its ground, and balanced that of centralization amongst the Germanic nations, and more particularly in England. There was the *shire-gemot*, or county court, which met twice a year; and the *burg-gemot*, which met thrice; the *hundred-gemot* (see HUNDRED), which met every month, and an extraordinary meeting of which was held twice a year; the hallegemote, or *court-baron*. These institutions excluded not only central despotism, but local tyranny in the shape of individual caprice. The ealdorman decided only with the assent of the shire-gemote, just as the king was dependent upon that of the witan. Lappenberg by Thorpe, ii. p. 322.

GEMS, ANCIENT. The term *gem*, which is applied to jewels and other valuable and precious stones, means in archæology engraved stones of the precious kinds, and even small engraved portions of hard and primitive rocks which have been set or worn as jewels by the ancients. Before entering, however, upon the subject of engraved stones, it will be necessary to mention the principal kinds which are mentioned by ancient authors, or have been found by modern researches to have been used for engraving.

Although the principal varieties of precious stones were known to the ancients, yet owing to the absence of scientific and chemical analysis, they appear to have distinguished precious, and other stones, only by color, specific gravity, and density. The different nomenclature, too, used by different authors, multiplied synonyms, and caused confusion; so that it has become impossible to identify all the stones mentioned by Theophrastus, Pliny, and others. As a general rule, the ancients did not engrave such precious stones as the diamond, ruby, and sapphire, being content with those of less hardness and value. The principal stones used by engravers were: (1) The carnelian, and its more transparent variety the sard, *sardion*, in common use in the days of Plato (so called from Sardes in Lydia, but chiefly obtained from India and Babylonia): (2) the chalcedony, supposed to be the ancient calchedonion, used for seals and reliefs, of which two kinds have been found: (3) the *onyx* or nail-stone, variously described by Pliny and his predecessors, but distinguished by a white layer resembling the nail: (4) the nicolo or *Ægyptilla*, obtained from the onyx, a blue spot with a black zone encircling it: (5) the *sardonyx*, which was a variety of the onyx, having black, blue, white, and red colors, and particularly used for cameos and vases, by cutting down the lighter colored layers to the darkest for a background to the figures, a stone much prized by the ancients; the signet of Scipio Africanus the elder being of this material, and the emperor Claudius esteeming it and the emerald above all other gems: (6) the agate or *achates*, so named from a Sicilian river, embraced many varieties, as the jaspachates, dendryachates, but confounded with the jasper, considered a charm against scorpions and spiders, used for whetstones, and a talisman by athletes; it was obtained from Egypt, Greece, and Asia: (7) plasma or the *prasius*, root of emerald, much used under the lower empire; its varieties were the *molochates* and *nilion:* (8) numerous varieties of the jasper, *iaspis*, green, blood-red, yellow, black, mottled or porcelain, and even blue, were employed for signets at the Roman period, and procured from India, Persia, and Cappadocia. Pliny mentions a remarkable statuette of Nero, weighing 15 ozs. in this material: (9) garnets, the *granatici* or red hyacinths of antiquity, which were principally in use at the latter days of the Roman empire, and amongst the oriental nations—with which may be classed: (10) the *carbunculus*, supposed, however, by some to be the name given by the ancients to the ruby, was brought from India, Garamantia, Carchedon, and Anthemusia: (11) the *hyacinthus* or jacinth, a yellow variety of the garnet, which was used for signets, and came from Ethiopia and Arabia: (12) the *lyncurium*, or *lychnis*, which is the ancient name of the true modern jacinth: (13) several varieties of the emerald or *smaragdus* are cited by the ancients, as the Bactrian or Scythian, supposed to be a green ruby, principally derived from the emerald mines at Zabora, in the neighborhood of Coptos, worked by conscripts, and described by Agatharcides; many remarkable stories are told of this gem, which has only been found with engravings of a later

period; one sent by a king of Babylon to a king of Egypt was 4 cubits long and 3 in width; an obelisk in the temple of Jupiter, 40 cubits high, is said to have been made out of four emeralds; and Theophrastus mentions an emerald column of great size in the temple of Hercules at Tyre; in the Egyptian labyrinths, according to Apion, was a colossal Serapis of great height, made of emerald; this stone was used by gem-engravers to "refresh" the sight, or inlaid in the eyes of statues, as in the lion at Cyprus, erected to Hermias; it was set in the ring of Polycrates; and used as a lens by Nero to behold the fights of the gladiators in the circus: (14) the beryl or *beryllus*, obtained from India, cut in shape of a hexagonal pyramid, was used at an early period for engraving: (15) the amethyst, brought from Arabia Petræa and Armenia Minor, is found used for intagli at all periods: (16) the *sapphirus* of the ancients, supposed by some to be *lapis lazuli*, came from Media, and appears in use amongst the Egyptians and Persians: (17) the *anthrax*, supposed to be the ruby, was not engraved; the hyacinthus has also been conjectured to be the blue sapphire: (18) the topaz, *topazon*, applied by the ancients to a green stone found by the Troglodytes in the island of Cytis, in the Arabian gulf, and first sent by Philemon to Berenice, out of which also a statue of Arsinoe was made and placed in the so-called "golden temple" by Ptolemy Philadelphus: (19) the *chrysolithus:* (20) chrysoprase, turquoise *callais:* (21) the *magnes*, or loadstone, were used for cylinders and gems of a late period: (22) the green tourmaline, or avanturine, *sandaresus:* (23) the obsidian, *obsidianus*, so called after its founder Obsidius, four elephants made of which were dedicated by Augustus in the temple of Concord were also known; and a statue of Menelaus, made of the same material, was returned to the Heliopolitans by Tiberius: (24) the *opal opalites*, or *pæderos*, obtained from India, the largest of which then known, of the size of a hazel-nut, belonging to the senator Nonius, was valued at about £2,000, which he would not yield to M. Antony; this stone was sometimes engraved: (25) the *adamas*, of which seven varieties were known to the ancients, was only used for cutting other gems, or worn rough, but was not engraved, or even faced, the art of polishing it having been discovered by Louis de Berghem in the 15th century. The list of Pliny, indeed, contains many other stones, which have been either confounded with those already described—their names having been derived from different sources—or else they are species of the same. Many of these had fanciful names, as (26) the *aromatites* of Arabia and Egypt, so called from its fragrance: (27) the *alectorius*, worn by the wrestler Milo, so called from being taken out of the gizzard of a fowl: (28) the aspilates, a fiery stone, said by Democritus to be found in the nest of Arabian birds. In the selection of stones for engraving, the gem-engravers adapted the material to the subject—Bacchanalian subjects were often engraved on amethysts; marine, on beryls; martial, on carnelians, sards, and red jaspers; rural, on green jasper; celestial, on chalcedonies. Superstitious virtues were also attributed to the different varieties of gems—thus the amethyst was supposed to protect from the influence of wine; and according to Dioscorides, the jasper was particularly adapted for amulets; and Alexander of Tralles recommends the subject of Hercules engraved on a Median stone, to be worn on the finger as a remedy against the colic.

The art of engraving precious stones at the earlier periods of the Egyptian monarchy was comparatively unknown, although these people made beads of carnelian, felspar, root of emerald, jaspers, lapis lazuli, amethyst, and other hard stones. For the purposes of seals, however, and for intagli, steatite scarabæi were generally used, and engraved gems are either of the greatest rarity or suspected, till the time of the Ptolemies. A very remarkable exception to this rule is a square signet of yellow jasper, engraved with the name and titles of Amenophis II. (about 1450 B.C.) and his horse, in the British museum. Under the Ptolemies and Romans, the Gnostic gems, called Abraxas, generally of lapis lazuli, blood-stone, and jasper, begin to appear, but these are made by the same process as the Greek, from which they were derived. The Ethiopians, according to Herodotus, engraved signets. The same may be said of the neighboring Phœnicia, which either imitated the cylinders of the Babylonians, or the scarabæi of the Etruscans. In Assyria, the oldest gems are of cylindrical shape, from 1 to 2 in. long, and half an inch thick, pierced through their long axis for a cord to attach round the wrist. The earlier ones are of serpentine, the later of the time of Sargon or Shalmaneser, of agate, jasper, quartz, and syenite, engraved with figures of the gods, and the names of their possessors in cuneiform. The inscriptions, indeed, are often difficult to read, but names similar to those of Assyrian and Babylonian monarchs occur, one cylinder having a name like that of Nebuchadnezzar. The Babylonian are of the same type, and chiefly of hæmatite, loadstone, steatite, and jasper; have also figures of deities and the names of deities or the possessors, generally executed in a coarse rude style by the graver. Oval gems, indeed, appear, from the impressions on the clay tablets, to have been in use at the same time; that of cylinders passed to the Persians, under whom the art became much better, and chance has preserved the cylinder signet of Darius I., found in Egypt. These cylinders were abandoned for conical gems, principally of chalcedony, engraved on the base with figures of deities, in use prior to the conquest of Alexander, and were at a later period, commencing in the 3d c. A.D., followed by hemispherical agate gems, with heads, animals, and Pehlevi inscriptions, generally of a rude and debased style of art. These, again, at a later period, were succeeded by convex stones *en cabochon*, often garnets, sards, carbuncles, engraved on the upper surface, with rude figures of animals,

heads and other devices also, accompanied with Pehlevi inscriptions, and these probably continued till the rise of Mohammedanism in the east, when the art was confined to the engraving of cufic legends on the most valuable of oriental stones, often with a great degree of dexterity. In Judea, the use of signets (see SEALS) prevailed, and the most important known instance is the Urim and Thummim, or breastplate of the high-priest, consisting of twelve precious stones, engraved with the names of the twelve tribes; but no Hebrew engraved stones earlier than the 5th or 6th century are known. Amongst the other oriental nations of antiquity, the Bactrians and early Hindus seem to have exercised the art of engraving on stones, although no works of great merit of these nations have been found, and those of a later age are mere seals engraved with sentences of the Koran, or the names of the possessors, and when smeared with black or colored inks, were impressed on documents as stamps. Of the other nations of antiquity, the Chinese only have had seals (see SEALS) of crystal, soapstone, porcelain, and other substances, with devices in relief for using as stamps, the subjects being mottoes from poetical and other works.

The Greeks, at the earliest period, are not supposed to have employed engraved stones for their signets, the earliest rings being of solid metal, such as the legendary ring of Minos; but at a later period, those of Helen, Ulysses, and the legendary one of Gyges, are said to have had engraved stones. Orestes, in the tragedies, is also recognized as the son of Agamemnon by his engraved ring; and Mnesarchos, the father of Pythagoras, who lived about 700 B.C., was an engraver of gems. The earliest instance of an engraved gem is the emerald ring of Polycrates, set in gold or engraved by Theodorus of Samos about 740 B.C.; while the laws of Solon against counterfeiting signets show that they may have been in early use. At the period of the Persian war they were by no means uncommon. Later, the writings of the Platonists and Stoics constantly allude to gems, and the flute-player Ismenias, 487 B.C., purchased an emerald engraved with a figure of Amymone. Still later, the poet Eupolis instances the extravagant prices given by the Cyrenæans for engraved stones in rings. Yet it is doubtful if any real Greek intagli earlier than the war of Peloponnesus can be identified, those hitherto cited, in low relief, inclosed in a guilloche or engrailed border, and of a hard and stiff style of art, having been probably cut from the bases of scarabæi of Etruscan work. At a later period, their use was universal, and the names of celebrated engravers, such as Pyrgoteles and Appollonides, are known, the first named having the privilege of engraving the portrait of the monarch, Alexander the Great; Ptolemy V., presented as a most precious gift his portrait engraved on an emerald to Lucullus; and Cleopatra had a gem with Bacchus. The style of engraving of this age is fine and noble, the hair indicated by fine wiry lines: the subjects are generally heroic, but busts and portraits of divine, regal, and historical personages appear. Sards, amethysts, and jacinths were in use.

Contemporaneous with the Greek school, if not earlier, was the Etruscan, consisting of scarabs entirely carved out of sard, carnelian, agate, with engraving often of exquisite work, but generally harsh, and sometimes of severe style, with subjects derived from the earliest Hellenic myths, and occasional inscriptions in the Etruscan language, the names of the personages represented, seldom more than one figure appearing on the gem. The subject is surrounded with a guilloche or engrailed border, and the scarabs were pierced through their long axis, to set as rings or to wear as other objects of attire. Similar scarabs, but of green jasper, and of Phœnician workmanship, have been found in Sardinia. These gems probably were made from the beginning to the middle of the 3d c. B.C., when Etruria fell into the power of the Romans, who derived their engraved stones from the Greek successors of Alexander, as engraved rings, with their subjects, are mentioned at the close of the republic, the device of Scipio Africanus being a head of Scyphax; that of Sylla, the submission of Jugurtha; of Pompey, a lion carrying a sword; and of Cæsar, Venus armed with a dart. So great had the passion for these charming little works of art increased, that Scaurus, the step-son of Sylla, had even a collection of gems, *dactyliotheca*. Pompey sent the collection of Mithridates as an offering to the capitol; and Cæsar, to outvie his great competitor, presented six such collections to the shrine of Venus Genetrix; and Marcellus, another to the cella of the Palatine Apollo. At the commencement of the empire, the portraits follow the costume and art of the period; the hair is expressed by broad strokes, the compositions rarely contain more than two figures. Artists of great merit, as Dioscorides, Apollonides, and Chronios flourished at this age.

The names of the artists who engraved the gems, and of the proprietors, are occasionally found upon them. The devices were various: Augustus had, first a sphinx, then his portrait engraved by Dioscorides; Nero, Apollo and the Muses; Galba used, first a dog, subsequently the head of Augustus. After the Antonines, indeed, the art rapidly declined, and portraits after Severus are rare, although even that of Mauricius is said to occur. At the middle period of the empire, the work is exceedingly rude, often merely scratched out by a diamond point in carnelians, jaspers, and garnets. Some works, indeed, of the later or Byzantine period exist, but they are of poor merit and execution, and the subjects are taken from Christian subjects. The gems of this later period are sometimes square, generally, however, the long or convex oval. The *camei*, or gems in relief, the ancient *ectypa sculptura*, appear at the period of the Roman empire. This term *camei*, of uncertain origin, is applied to engravings on stones of

two or more layers, such as the onyx or sardonyx, and niccolo, and is different from the relief-gems cut out of stones of one color. Ancient camei, indeed, are of the greatest rariety, and are not older than the imperial days of Rome. The smaller ones were used for rings; the larger, which are often perforated, are supposed to have been worn in the armor or dress, *phaleræ*. They were worked out with the diamond point: chiseled, so to say, out of the stone; and have, when examined, a rough appearance. The most remarkable ancient camie known are those of the Vienna collection, supposed to represent the apotheosis of Augustus, on which are Augustus, Jupiter, and Rome enthroned, the Earth, Ocean, Abundance, Germanicus, Victory, a triumphal car, Tiberius, and German captives; another, in the same collection, with Ptolemy II. and Arsinoe, the great cameo in the Bibliotheque at Paris, representing the apotheosis of Augustus; another to the collection of the Netherlands; and a fourth in the Vatican; a cameo at St. Petersburgh, one foot long, and another, eight and a half inches wide by six inches high, in the Marlborough collection, with the heads of Didius, Julian and Manlia Scantilla. At a later period, the art had considerably declined, and the Christians of the later days of the empire were content with engraving inscriptions on camei. These gems were principally worn as objects of attire, and Aeliogabulus is said to have placed even intagli in his shoes. The names of artists are rarely found upon camei; a celebrated one of the Marlborough collection, indeed, has the name of Tryphon, but there is considerable doubt about the authenticity of the inscription.

The subjects of ancient gems embrace the whole circle of ancient art, and follow the laws of its development, animal forms being succeeded by those of deities and subjects derived from the battles of Greeks and Amazons and Centaurs, the exploits of Hercules, and other heroes; then by scenes from tragedians and later myths; and, finally by portraits, historical representations, and allegories. The inscriptions consist of the names of deities, heroes, and subjects; dedications to deities; the names of artists, sometimes in the genitive case, but often accompanied with the verb *epoei*, "was making" (he affected imperfect use after the time of Alexander the great); addresses to individuals; gnomic or other sayings, indicating that the gems are amulets against demons, thieves, and various evils; or charms for procuring love; the names of the possessors, and sometimes addresses, occasionally even distichs of poetry, and various mottoes. These inscriptions were often added by subsequent possessors, and are not of the age of the gem itself. The number of artists, although very considerable, does not exceed 100 authentic names; and the true names are supposed to be distinguished from false ones by being placed at the side of the composition in very small letters terminating in dots; but even these have been successfully imitated by modern artists, and the greatest criticism and learning have been displayed to detect real ancient names by their orthography and palæography. The number of false antique stones produced by eminent engravers since the revival of the arts, has rendered the diagnosis of gems so difficult, that no branch of archæology requires greater judgment. All gems of high artistic merit and great finish are suspected, especially those with groups of many figures, regular edges, and polished faces, or too great a polish in the deep parts. Coarser imitations have been produced by backing pastes or colored glass (see GEMS, IMITATION) with stones, and mounting them in rings, so as too pass for a gem. The appearance of wear and friction has been produced by introducing them for awhile into the gizzards of turkeys, or in pierced boxes plunged in the beds of rivers. The judgment upon gems can be, however, only matured by a careful study and familiarity with all branches of ancient art. The coarser imitations of pastes, the tongue, the file, and the graver will detect; but old gems re-engraved, or new compositions invented, require the most careful survey. The place or circumstance of discovery is only a feeble guarantee against deception, the commerce in false antiques being successfully plied upon the unwary even in the far east.

The chief implement used by the ancient engravers appears to have been made by splitting diamonds into splints (*adamantis crustæ*) by a heavy hammer, and then fixing these points like glaziers' diamonds into iron instruments, with which the work was executed by the hand (*ferra retusa*). The drill, *terebra*, was also extensively used for hollowing out the deeper and larger parts of the work, and emery powder, the *samaris* or Naxian stone, for polishing. The so-called wheel, a minute disk of copper, secured to the end of a spindle, and moistened with emery powder or diamond dust, and driven by a lathe, does not appear to have come into use till the Byzantine epoch. It has been conjectured that the artist used lenses of some kind, or globes filled with water, to execute his minute work; but the ancient, like the modern engraver, rather felt than saw his way. All these processes were not employed by the same artist, for besides the engraver (*scalptor cavarius, dactyliographus*), there was a polisher (*politor*), not to mention arrangers (*compositores gemmarum*), and merchants (*gemmarii, mangones gemmarum*) who drove a flourishing trade in emeralds and pearls and engraved stones in the days of Horace.

The general fall of the arts at the period of the Byzantine empire, seems to have been accompanied by the decline of the art of engraving on gems; and the Merovingian and Carlovingian monarchs were obliged to use antique gems, instead of those engraved by the artists of their day. Rock-crystals, however, were engaged in a Byzantine style of art, with sacred subjects, in the 9th c.; but the art was all but lost till the rise of Lorenzo de Medici, when Giovanni delle Corniole, at Florence, and Domenico dei

Camei, at Milan, worked under his patronage. A subsequent school of gem-engravers originated with Pietro Maria de Pescia, who worked for Leo X.; the chief representatives of the school are Michelino, Matteo de Benedetti, the celebrated painters Francia, M. A. Moretti, Caradosso of Milan, Severo of Ravenna, Leonardo da Vinci, J. Tagliacarne, Bernardi of Castel Bolognese, who died 1555, celebrated for a Tityus copied from M. Angelo. These were succeeded by Matteo del Nassaro of Verona, who worked for Francis I., and produced a crucifixion on heliotrope, so that the red spots seemed drops of blood issuing from the wounds of Christ; Caraglio, who flourished in Poland in 1569; Valerio dei Belli, who chiefly employed rock-crystal; Marmita, Domenico di Polo, Nanni, Anichini of Ferrara, and Alessandro Cesari, celebrated for a cameo head of Phocion; Dei Rossi, a Milanese, engraved the largest cameo of modern times; Jacomo da Trezzo, celebrated for his portrait, is said to have been the first to engrave on the diamond in 1564—an honor disputed, however, by Birago, another Milanese, both artists having been in the service of Philip II. of Spain, who made a portrait of Don Carlos and the arms of Spain on this gem.

The art, which had declined at the close of the 16th c. in Italy, flourished in the 17th c. in Germany under Rudolph II., for whom Lehmann engraved at Vienna; and in France, where Coldoré worked for Henri IV. and Louis XIII. In the 17th c., Sirletti, who died at Rome in 1737, excelled in portraits, and copied antique statues with great excellence. The two Costanzi are celebrated in 1790, one for the head of Nero on a diamond. Rega of Naples is said to have come nearest to the antique. Natter of Nuremburg, who died in 1763, is celebrated for his intagli; Guay and Barier were celebrated in the French school; and the English produced Reisen, who died 1725; Claus, who died 1739; Smart, celebrated for the rapidity of his works; and his pupil Seaton, a Scotchman, who engraved portraits of the great men of his day. The greatest artist of the age, however, was Natter. Of the subsequent Italian school, Ghinghi, Girometti, Cerbara, Bernini, and Putenati are much praised. The 19th c. produced many good English engravers, as Marchant, Burch, Wray, and Tassie; while Pistrucci, celebrated for his charming cameo, Weigall, and Saulini, who made intagli, complete the list of modern gem-engravers.

With respect to ancient gems in the dark and middle ages, they were preserved in shrines, châsses, and other ecclesiastical vessels in which they were set, the passion for collecting them as works of art having commenced with Lorenzo de Medici, who formed the Florentine collection, and had his name incised on his gems. The large camei of the European collections, however, appear to have been brought by the Crusaders from the East. The French collection dates from Charles IX., and was augmented by the successive kings of France; it is very rich in gems of all kinds; that of Berlin, containing the united cabinets of the Elector of Brandenburg and the Markgraf of Anspach, collected by Stosch, consists of nearly 5000 stones. The Vienna collection, far less numerous, is remarkable for its large camei. In England, the collection of the British Museum, collected originally by Townley, Hamilton, Payne, Knight, and Cracherode, consists of about 500 stones, some of great beauty and merit, but is very poor in camei. The private collection of the Duke of Devonshire, formed in the last half century, comprises upwards of 500 intagli and camei, including some of the finest known. The Marlborough, still more numerous, comprises many fine camei and intagli, and numerous works of the renaissance. The Pulzky collection, now in Italy, contains many rare and choice intagli. A celebrated collection, the Poniatowsky, formed upon the base of the old collection of Stanislaus, last king of Poland, was so filled with forgeries by its last possessor, executed by Roman artists, with inscriptions by Diez, that it entirely lost its value on dispersion. The Hertz collection, the last great one sold, was remarkably rich in fine Etruscan scàrabæi and other intagli. There are probably about 10,000 gems reputed to be antique. Yet these are only a mere instalment of those formerly existing. The immense value placed by the ancients on their gems, may be seen by the scabbard of Mithridates, valued at 400 talents, or £7572; the pearl given by Julius Cæsar to Servilia, worth £4800; that swallowed by Cleopatra, valued at £5000; and the pearls and emeralds worn by Lollia Paulina, wife of Caligula, valued at £320,000—all the spoils of provinces and the heirlooms of her family. These, indeed, were probably not engraved, but in modern times great sums have been paid to celebrated engravers—as much as £800 for one cameo.

Although the acquisition of gems is too costly for private individuals, impressions in glass, called pastes (see GLASS), in sulphur, gutta percha, or plaster of Paris, can be easily obtained, and they answer almost all the purposes of study. Some ancient impressions in terra cotta, indeed, exist, and the poorer classes of Greece and Rome were content with glass pastes. The value of antique gems, owing to the great difficulty of discerning those really so, has considerably declined in this country, and even their authority is very cautiously cited by archæologists. The principal writers of antiquity who treated of gems are, Onomacritus or the Pseudo-Orpheus, Dionysius Periegetes, Theophrastus, and Pliny, whose chapter is complied from antecedent Greek and Roman authors. Isidorus, 630 A.D., gives an account of the principal stones; so do Psellus and Marbodus in the 11th c.; Mariette, *Pierres Gravées* (4to, Paris, 1850); Raspe, *Catalogue des Empruntes des Pierres Gravées* (4to, Lond. 1757); Millin, *Introduction à l'Etude des Pierres Gravées* 12mo, Paris, 1796); Krause, *Pyrgoteles* (8vo, Halle, 1856); Koehler, *Ueber*

die Geschnittene Steine (8vo, St. Petersb. 1851); King, *Antique Gems* (8vo, Lond. 1860); Bucher, *Gesch. der technischen Künste* (1875).

GEMS, Artificial. Ever since the chemical composition of our most valued gems —the diamond, ruby, opal, &c.—has been known, attempts have been made, with more or less success, to reconstruct them in the laboratory by the influence of intense heat, electrical action, &c. Amongst the most successful workers in this field, we may mention Ebelmen,* Despretz, Sainte-Claire Déville, and Becquerel.

There are at present no reasons for believing that diamonds of any appreciable size will be formed artificially; Despretz, however, succeeded, by intense voltaic action, in obtaining minute, dark-colored crystals of carbon.

Boron was discovered simultaneously in 1807 by Davy in England, and by Gay-Lussac and Thénard in France. It is possible that, in the discovery of crystallized boron, we have advanced a step toward the artificial production of the diamond. The boron crystals possess a brilliancy, hardness, and refractive power scarcely inferior to those of the diamond.

Sainte-Claire Déville and Caron have published a very important memoir in the *Comptes Rendus* (1858, vol. xlvi.), in which they describe various processes by which they have succeeded in obtaining small crystals of white and green corundum, rubies, sapphires, etc. By the action of the vapors of fluoride of aluminium and boracic acid on one another, they obtained crystalized alumina (corundum) in large, but thin crystals, some of which were about .4 of an inch in length, and which in their hardness, and in all their optical and crystallo-graphic properties, resembled natural corundum. When a little fluoride of chromium was added, a similar process yielded violet-red rubies of a perfectly natural tint; with rather more fluoride of chromium, blue sapphires were yielded; and with still more of this ingredient, green corundum was obtained, presenting the natural tint of the variety known as ouvaroffite. A mixture of equal equivalents of the fluorides of aluminium and glucinum, when similarly acted on by boracic acid, yielded crystals of chrysoberyl or cynophane, which, although very minute, were perfect in their form, and in all respects resembled the natural crystals. The action of fluoride of silicium on zirconia yields small crystals of zircon or hyacinth (Zr_2O_3,SiO_3); and by the action of silicic acid on a mixture of the fluorides of aluminum and glucinum, hexagonal plates of extreme hardness were obtained, which in some respects resembled emerald (which they were attempting to form), but were not identical in composition with that gem.

Other researches on this subject are those of Becquerel, in the *Comptes Rendus* (1861, vol. liii. p. 1196). After having for many years tried to obtain gems from solutions of silicates, and by feeble electric currents, he then used intense currents, with high tension, and in this way succeeded in obtaining opals, etc. The latest and most successful processes are those of M. Ch. Feil of Paris, who, following out the experiments of Ebelmen, which failed only in consequence of his inability to produce a sufficiently intense heat, has now attained perfect success by the aid of the oxy-hydrogen blow-pipe in fusing and bringing to a crystalline state the materials composing the ruby, emerald, sapphire, topaz, and amethyst, with the alumina base.

GEMS, Artificial (*ante*). Artificial gems, properly so-called, are identical in properties and chemical composition with the natural gems. The chemical composition of minerals, including gems, unlike crystallized salts, varies within limits. The production of artificial gems is interesting for two reasons: first, scientifically, from the light thrown upon the conditions under which gems are formed in nature; second, commercially, as foreshadowing the time when they can be made of a size, and at a cost, which will render their manufacture profitable.

Although methods for the artificial production of rubies and sapphires have been known—at least since 1858—the results communicated to the Parisian Academy by MM. E. Frémy and Feil in the latter part of 1877 are far more satisfactory. Rubies and sapphires are colored corundums; therefore, the first problem is the formation of corundums which are composed of alumina (Al_2O_3), and, after that has been solved it is necessary only to incorporate with the corundum mixture the proper metallic oxides to obtain the gems. The theory upon which these experimenters worked was to displace the alumina from its silicate by fusion with a base having a stronger combining power with the silicic acid. The best results were obtained by placing equal parts of porcelain-clay and red-lead in a large crucible, inclosing this in a second, and exposing them for several weeks to an intense red heat in a glass furnace. Two crucibles are necessary, as the lead combines with the silica of the inner one and eats holes through it. Upon allowing the crucibles to cool and breaking the inner one, two strata were found, an upper glassy one, chiefly of silicate of lead, and a lower one containing clusters of corundum crystals. The silicate of lead was removed by melting with oxide of lead or potash. These crystals cut glass, rock crystals, and even topaz, and are exceeded in hardness by only the diamond and crystalline boron. By adding two or three per cent of bichromate of potash, rubies were formed; while sapphires were obtained by using a smaller quantity of bichromate of potash and still less of oxide of cobalt. These gems

* Ebelmen's memoirs on this department of chemistry are contained in the first volume of Salvetat's *Recueil des Travaux Scientifiques de M. Ebelmen.* Paris, 1855.

presented qualities in every respect like the natural ones, while diamond cutters who ground the rubies found them harder; they will probably outwear the natural rubies when used in watches.

At the same meeting at which the memoir of MM. Frémy and Feil was presented, M. Monnier announced that upon cautiously pouring a very dilute solution of oxalic acid upon a solution of silicate of soda as thick as molasses, the silicic acid separated slowly and was deposited, forming opals. By using a solution of nickelous sulphate, apple-green stores such as chrysoprase were formed.

Since 1828 many attempts have been made to produce diamonds by various methods, some of which claim to have been successful. Feb. 26, 1880, Mr. J. B. Hanney, of Glasgow, Scotland, read a preliminary notice before the Royal Society "On the Artificial Formation of the Diamond," and exhibited a number which he had made. In experimenting upon the solubility of solids in vapors immediately beyond the "critical point"—i e., matter *in transitu* between the liquid and gaseous states—Mr. Hanney found that the solvent power of water was greatly increased, even dissolving to a considerable extent alumina and silica, which are unaffected under ordinary conditions. He further found that upon withdrawal or dilution of the solvent gas, crystalline solids were deposited. These facts suggested the possibility that a solvent might be found for carbon, and diamond crystals be deposited from this solution. After a number of unsuccessful experiments upon the common forms of carbon—charcoal, lampblack, and black-lead—he turned to indirect methods. Remembering that the elements are much more energetic in their action when nascent, or just set free from combination, and having ascertained that upon heating a gas containing hydrogen and carbon, under pressure, in the presence of a metal, the metal attracts the hydrogen and liberates the carbon—it remained only to find a solvent for the nascent carbon, and this he finally found. His method was as follows: In a strong iron tube 20 inches long, 4 inches in diameter, and having a bore of one-half inch, some lithium, and a mixture of highly rectified bone-oil and paraffine-spirit were placed, and the end securely closed with a screw plug. After heating the tube for 14 hours and allowing it to cool, it was opened and, after the gas had passed out, a hard smooth mass was discovered at the upper end of the tube. Upon removing and pulverizing this mass, some hard particles were found which were tested by Profs. Maskelyne, Roscoe, and Dewar, and declared to be diamonds. Mr. Hanney's experiments proved the necessity for the presence of a stable compound containing nitrogen. Thus far it has cost five pounds to produce five shillings' worth of diamond, but further researches will undoubtedly cheapen the process. This is justly considered to be a triumph of chemistry, removing the reproach that, while chemists had built up synthethically many complex organic compounds, they had not produced a diamond composed, as it is, of the single element carbon that underlies the whole. And, among the achievements of the future may be the production of a Koh-i-noor, though, in this case, Nature holds great odds against man, as immense periods of time and great pressures—which are required for the growth of minerals—tax neither her powers nor her patience.

GEMS, Imitation, or Pastes, *Pierres Précieuses Artificielles*, French imitations of the precious stones, are made of glass specially prepared. It differs from ordinary glass in its greater density; at the same time it is made with the greatest possible amount of transparency and purity. Its composition, generally, may be said to be silica of very pure quality, probably quartz crystals, potash, and oxide of lead; but the exact proportions are varied almost by every maker, and each has a secret ingredient or two to add.

The colors employed are usually the same as those used for coloring ordinary ornamental glass, but upon their careful admixture, and upon the skilful cutting to represent the crystalline form of the real gem, the success of the manufacture chiefly depends. By some persons, the cutting is carried to such a marvelous perfection, that their work would deceive the eye of most ordinary judges, when well set and *foiled*, or backed with silver or tinfoil. See Foil.

The glass used for artificial gems is very generally called *strass*, from the name of a German who claimed the invention. But if we seek the real inventor of factitious gems, we must go far beyond the time of Strass, for we find Pliny describing, under the name of *gemmæ vitreæ*, certain imitations of precious stones which were known in his time, some of which were certainly made of colored glass, and others by ingeniously cementing together layers of variously colored transparent stones. And Seneca (Epist. ix.) mentions that one Democritus had invented a process for imitating emeralds by giving a green color to rock-crystal. Other allusions are plentifully scattered through the works of classical authors; and ancient artificial gems themselves exist, two especially famous being imitations of a chrysolite and an emerald, amongst the Roman antiquities in the Museum Victorium at Rome.

The manufacture of factitious gems is chiefly carried on in Switzerland, and like the polishing of diamonds in Holland, is engrossed by a small community in the French commune of Septmoncel, on the Jura Alps, 16 miles from Geneva. Upwards of a hundred artisans are there employed in this manufacture, and they make almost enough to supply the whole world. Much common colored glass is cut up in this country for the purpose

of making the gilt-toy jewelery, but the writer believes that a small manufacturer of the name of Weston, in Birmingham, is the only person who attempts fine imitations of precious stones with colored strass. The following are a few known formulas for imitating gems: *Amethyst*—Strass, 500 parts; oxide of manganese, 3 parts; and oxide of cobalt, 2 parts. *Diamond*—Perfectly pure rock-crystal, 1600 parts; biborate of soda, 560 parts; very pure carbonate of lead, 3,200 parts; oxide of manganese, 1 part. A glass, consisting only of the oxide of tin, fused, is used for the so-called Parisian diamonds; they are the nearest in brilliancy to the real gem when newly made, but they soon lose their brilliancy. *Emerald*—Strass, 7,000 parts; carbonate of copper, 65 parts; glass of antimony, 7 parts. *Garnet, Oriental*—Strass, 1200 parts; glass of antimony, 580 parts; purple of Cassius, 3 parts; binoxide of manganese, 8 parts. *Ruby*—Strass, 45 parts; binoxide of manganese, 1 part. *Sapphire*—Strass, 3,600 parts; oxide of cobalt, 50 parts; oxide of manganese, 11 parts. *Topaz*—Strass, 1050 parts; glass of antimony, 44 parts; purple of Cassius, 1 part.

GEMS-BOK, *Antilope Oryx*, or *Oryx Gazella*, a species of antelope, described by some naturalists as the oryx, but which, being a native of South Africa only, cannot be the oryx (q.v.) of the ancients, although it is certainly a nearly allied species. It is a heavy, stout animal, about the size of a stag, with rough, reversed hair on the neck and along the ridge of the back; large pointed ears; and almost perfectly straight horns, fully 2 ft. long, in the plane of the forehead, little diverging, and obscurely ringed at the base. The colors are harshly contrasted, dark rusty gray above, and white on the under parts, separated by a broad dark brown or black band; the head white, with black transverse bands; the thighs black, and the legs white. The hoofs are remarkably long, adapted to the rocky, mountainous districts which the animal frequents. The gems-bok makes use of its horns as sometimes even to beat off the lion. It inhabits districts free from wood, and is generally found in pairs or in very small herds.

GEMSHORN, a well-known organ-stop in German organs, the pipes of which are made of tin, and are conically shaped, being much narrower at the open end; while at the mouth, at the broad end, there are ears on each to regulate the tuning. It has a peculiarly pleasant tone, of a different character from either an open cylinder pipe or a stopped pipe. The pitch of the gemshorn is generally 8 ft. tone, sometimes it is 4 ft., and in the pedal organ 16 feet.

GEMÜNDER, George, a violin maker, b. Würtemberg, 1816. He learned his art of the well known Baptiste Vuillaume of Paris, and coming to the United States, in 1847, established himself at Boston as a musical instrument maker. One secret of the great success he obtained with his violins was the fact that he used wood in its natural condition, rejecting the chemical preparation by which earlier makers had endeavored to impart a certain condition of ripeness to the wood. His violins obtained the first prize at the London international exhibition in 1851, and he met with equal appreciation in Vienna.

GENDARMES (men-at-arms), originally, and up to the time of the first French revolution, the most distinguished cavalry corps in the service of the Bourbon kings, to whom they formed a sort of body-guard. Under existing arrangements, the gendarmes constitute a military police, and comprise both calvary and infantry. The force consists principally of soldiers taken from the army, generally on account of intelligence and good conduct. The men receive much higher pay than the rest of the army, of which, however, the corps is a part, and they are liable in cases of emergency to be sent on active service. The gendarmes amount to about 27,000 men, and are intrusted with the execution of many of the most delicate details of government.

GENDER (Fr. *gendre*, from Lat. *genus*, *generis*, race, kind), in grammar, is a distinction among words depending upon sex. Names applied to the male sex are said to be of the *masculine* gender, as *man*, *poet;* those applied to the female sex, *feminine*, as *woman*, *poetess;* words that are neither masculine nor feminine are, as it was expressed in Latin, *neutrius generis*, "of neither gender;" and from this phrase grammarians have come to speak, somewhat incorrectly, of this class of words as being "of the neuter gender," and hence to reckon three genders. In English, the distinction of gender in nouns is chiefly marked in the pronouns substituted for them—*he*, *she*, *it*. Gender, strictly speaking, is applicable only to living beings distinguishable as male and female; but by the figure of speech called personification (q.v.), inanimate objects are often spoken of as *he* and *she*. In the infancy of language, however, when every word was what we should now call a metaphor—when every thing that moved or was seen to produce any effect, was conceived as actuated by a conscious will, like that which the spectator felt within himself—every prominent or interesting object in the universe would be invested with one or the other sex, according to the analogy it suggested. In Latin, accordingly, *gladius*, a sword, was considered masculine; *navis*, a ship, as feminine; and *pomum*, a fruit or apple, was thought of as without sex. Similarly, in Sanscrit and Greek, the greater part of inanimate objects are either masculine or feminine, the others being neuter. In Hebrew, everything is either masculine or feminine, there being no neuter; and this is the case in the modern languages derived from the Latin, viz., Italian, French, Spanish, and Portuguese—everything is either a *he* or a *she*.

German resembles the classic languages in making some inanimate objects masculine, some feminine, and others neuter. Thus at table, a man must speak of the spoon (*der löffel*) as "he," of the fork (*die gabel*) as "she," and of the knife (*das messer*) as "it." English—in this more rational than any of its congeners—has banished the spurious distinctions of gender that encumbered the Anglo-Saxon like the other Teutonic tongues, and attributes sex only to living beings.

In the highly inflected languages, there are certain terminations distinctive of the different genders. It is probable, indeed, that originally every noun, substantive, or adjective, had a suffix indicative of the sex, real or imaginary, of the object designated, although, like other inflections (q.v.), these suffixes of gender were in process of time mutilated beyond recognition, or in many cases altogether worn off. The terminations most characteristic of the three genders in Latin are mas. *us;* fem. *a;* neut. *um;* corresponding to the Greek *os, ē, on.* In a great majority of the adjectives in both those languages, the genders are thus marked. In English, the gender of a noun affects only the personal pronoun substituted for it; in most other languages, the adjectives (including the articles) have different forms for the several genders—a useless complication, in the case of modern languages at least. See ADJECTIVE.

Of the terminations distinctive of gender observable in modern English, some are purely Latin, as in *executor, executrix;* the feminine *-ess*, as in *countess*, is borrowed from the French, and is also of classical origin. The prevalent feminine termination in German is *-inn*, as in *tänzerinn*, a female dancer (Fr. *danseuse*); of this there are two instances in English, in the provincial *carlin*, the fem. of *carl*, and *vixen* = Ger. *füchsinn*, a female fox. This affix was already in use in Latin, as in *regina*, a queen (*reg(s)*, a king); and in this form it is used in Europe generally to femininize proper names; e.g., *Georgina, Wilhelmina, Caroline.*

In such pairs as *son—daughter; man—maid; horse—mare; cock—hen;* there is no etymological relation between the words; they are from distinct roots. But with regard to *hen*, e.g., the Anglo-Saxon had the two forms, *han* for the male, and *hen* for the female; and *mare* was originally applicable to both sexes, as *horse* still is (Fr. *maréchal*, originally an officer who had charge of the horses). The oldest known form of the Teutonic speech, the Gothic, had the two words, *magus*, son, and *magaths*, daughter, both from the root *mag*, to beget, or to make. *Magaths* has become in Ger. *magd*, in Eng. *maid; magus* has been lost in the Teutonic tongues, but it is represented by the Celtic *mac* (son), evidently from the same root. *King; queen*, were in Sans. *ganika*, father, and *goni*, mother, both from the root *gan*, to generate, produce. The masculine form appears in old Ger. as *chunig*, in modern Ger. *könig*, in Eng. *king;* the feminine became the Greek *gynē*, a woman, as well as the Saxon *cwen*, Sw. *quinna*, old Eng. *quene* or *quean*, applied to a woman generally, and the modern, *queen*, the chief woman of the land.

GENEALOGY (Lat. and Gr. *genealogia;* from Gr. *genos*, race, and *logos*, discourse) is the name applied to the science of the origin, sequence, and affinities of families. Although in itself it is not of sufficient importance to rank as an independent science, yet in so far as it has to do with remarkable and influential families, it forms a very important part of history. It naturally divides itself into two parts, *theoretical* and *practical*. The former embraces the principles on which the science of genealogy is based, while the latter is occupied with tracing the course of particular families themselves. To render perceptible to the senses the descent and relationship of individuals, genealogical tables are made use of, whose arrangement depends on the special purpose for which they are constructed. Usually, however, such tables begin with the earliest ancestor (Ger. *stammvater*) of a family, from whom all the known members of both sexes are traced in the order of descent. The importance of this branch of human knowledge, however, is perhaps less obvious in a scientific than in a legal aspect, where it is concerned about the various claims or pretensions of persons based on real or alleged relationship, more especially in regard to rights of succession. The earliest traces of genealogy are to be found in the ancestral catalogues of the heroes of the old world. Among the Hebrews, there were parties specially appointed to draw up genealogical tables. The progress of civilization in states, and in particular the institution of corporations and guilds in the towns, afforded a wider scope for genealogy. But the absence of criticism, and the desire to flatter the great, were the causes of introducing—especially after the 14th c.—the most ridiculous fables into genealogy. Ancestors were fabricated in the most impudently false manner, and families carried back in an unbroken line, not only to the age of Charlemagne, but even, in many cases, to the heroes of the Trojan war. The fact, however, is, that scarcely any family, however distinguished, can trace its ancestors even to the middle of the 11th century. Among the earlier works on genealogy are Ruxner's *Turnierbuch* (Simmern, 1527) and the genealogical tables of Reusner and Hennings, about the end of the 16th c., but these are not conceived in a historical spirit. A more luminous treatment of the subject was initiated in France by Duchesne, St. Marthe, Hozier, Chifflet, Lancelot le Blond, etc., and in England by Dugdale. Rittershusius of Altdorf (died 1670) and Spener of Wittenberg (died 1730) were the first in Germany to base genealogy on documentary evidence. The path entered on by them has been prosecuted by König, Von Imhof, and

especially by Hübner in his *Genealogische Tabellen* (4 vols. Leip. 1725–33· new edit., 1737–66), to which Lenz added *Erläuterungen* (Elucidations, Leip. 1756), and Sophia, queen of Denmark, *Supplement-tafeln* (Kopenh. 1822–24). Gatterer, in his *Abriss der Genealogie* (Gött. 1788), founded the scientific treatment of the subject, in which he was followed by Putter in his *Tabulæ Genealogicæ*, by Koch in his *Tables Généalogiques des Maisons Souveraines d'Europe* (Ger. Berlin, 1808), and by Voigtel in his *Genealogische Tabellen* (1810).

In Great Britain, the chief printed collections of genealogical information are the *Peerages*, *Baronages*, *Baronetages*, and *County Histories*. The chief manuscript sources are the public records, heraldic registers, and the parish registers of births, marriages, and deaths.

GENELLI, Giovanni Buonaventura, 1798–1868; b. Berlin; was the son of Janus Genelli, a painter, whose landscapes are still preserved in the Schloss at Berlin, and grandson to Joseph Genelli, a Roman embroiderer employed to found a school of gobelins by Frederick the Great. Buonaventura Genelli first took lessons from his father and then became a student of the Berlin Academy. After serving his time in the guards he went with a stipend to Rome, where he lived ten years as assistant to Koch, the landscape painter, for whom he conceived a great friendship, and who was a colleague of Hahnel, Reinhard, Overbeck and Fuhrich, all of whom are well known in art. In 1830, he was commissioned by Dr. Hartel to adorn a villa at Leipsic with frescoes, but quarreling with his patron he withdrew to Munich, where he earned a scanty livelihood at first, although he succeeded at last in acquiring repute as an illustrative and figure draughtsman. In 1859, he was appointed professor at Weimar, where he ended his days. Genelli painted few pictures, and it is very rare to find his canvasses in public galleries, but there are six of his compositions in oil in the Schack collection at Munich. These and numerous water-colors, as well as designs for engravings and lithographs, reveal an artist of considerable power whose ideal was the antique, but who was also fascinated by the works of Michel Angelo. Though a German by birth, his style was unlike that of Overbeck or Fuhrich, whose art was reminiscent of the old masters of their own country.

GENERAL (of religious order), in the Roman Catholic church, the supreme head, under the pope, of the aggregated communities throughout Christendom belonging to a religious order. The governing authorities of the monastic orders in the Roman Catholic church may be arranged in three classes: (1.) The superiors of individual convents or communities, called in different orders by the various names of abbot, prior, rector, guardian, etc.; (2.) The provincials, who have authority over all the convents of an entire province—the provinces, in the monastic sense of the word, being usually coincident as to local limits with the several kingdoms in which the order is established; (3.) The general, to whom not only each member of the order, but all the various officials of every rank, are absolutely subject. The general is usually elected commonly by the general chapter of the order, which, in the majority of orders, consists properly of the provincials; with whom, however, are commonly associated the heads of the more important monasteries, as also the superiors of certain subdivisions of provinces. The office of general in most orders is held for three years. In that of the Jesuits it is for life; but in all, the election of the general chapter must be confirmed by the pope. In most orders, too, there is assigned to the general a consultor (*admonitor*) or associate (*socius*), who, however, is only entitled to advise, but has no authority to control the superior. The general also is supposed to consult with and to receive reports from the various local superiors. He sends, if necessary, a visitor to inquire into particular abuses, or to report upon such controversies as may arise, and he holds a general chapter of the order at stated times, which differ according to the usage of the several orders. The general is exempt from episcopal jurisdiction, being subject to the immediate jurisdiction of the pope himself. He resides in Rome, where he enjoys certain privileges, the most important of which is the right to sit and vote with the bishops in a general council of the church.

GENERAL AGENT. See AGENT, PRINCIPAL AND AGENT.

GENERAL ASSEMBLY. See ASSEMBLY, GENERAL.

GENERAL CONVENTION OF THE PROTESTANT EPISCOPAL CHURCH. During the period of colonial dependence the Episcopalians of this country were members of the church of England: under the jurisdiction of the bishop of London. But the war of independence having severed these bonds, it became necessary to obtain episcopal supervision, and to establish an organization under which all the churches of the denomination might unite. To accomplish the latter object clerical and lay delegates from New York, New Jersey, Pennsylvania, Maryland and Delaware assembled at New York in Oct., 1784, and, having agreed on a declaration of fundamental principles, resolved that a convention should be held in Philadelphia the next year. At that place and time delegates were present from Virginia and South Carolina, as well as from the states represented before. At the convention of 1789, Bishop Seabury and delegates from the eastern states took their seats. A constitution was adopted which, in substance, continues in force to the present time. Under it, a general convention of the whole

Episcopal church in this country meets once in three years consisting, I., of all the bishops, who form a separate house, and, II., of four clerical and four lay delegates (communicants) from each diocese. The house of bishops has a negative (if declared within three days) on acts passed by the house of deputies; and all acts of the convention must be authenticated by both houses. As originally adopted, the constitution gave the convention power to consent to the formation of new dioceses, to provide the mode of trying accused bishops, to establish and revise a book of common prayer, and to regulate various matters connected with the order and efficiency of churches and dioceses. In fact, however, it is said the convention has never restricted itself to the powers originally specified, but has gradually developed into the governing body of the Protestant Episcopal church. Some theologians of that church think that in doing so it has exceeded its lawful powers; others hold that those powers are general and unlimited.

GENERAL COUNCIL. See PRIVY COUNCIL.

GENERAL DEMURRER, in English pleading, was a demurrer (q.v.) without showing special cause. Where the objection to the pleading was for want of form, a special demurrer was necessary; but where the defect was in substance, a general demurrer was sufficient. By the common law procedure act (1852), special demurrers have been abolished, and the distinction has ceased to exist.

GENERAL ISSUE, in English pleading, is the form in which the defendant traverses or meets with a simple denial the whole allegations, or the principal fact on which the plaintiff relies in his declaration. Thus, in actions founded on wrongs, the general issue is "not guilty;" in actions of debt, that the defendant never was indebted; in actions on a deed or bond, *non est factum*, i.e., that it is not the deed of the defendant. Under this issue, the defendant may prove that he never executed the deed; but not that it is bad in point of law. In *criminal proceedings*, the general issue is "not guilty," by which plea, without further form, every person, not having the privilege of peerage, upon being arraigned upon any indictment for treason, felony, or piracy, is deemed to have put himself upon the country for trial. Where a prisoner refuses to plead, a plea of not guilty may be entered for him, 7 and 8 Geo. IV. c. 28. Under the plea of not guilty, the prisoner is entitled to give in evidence not only everything which negatives the charge, but also all matter of excuse or justification.

GENERALIZATION. Our experience of the world leads us to recognize not only great variety, but also numerous instances of agreement in the midst of the variety. We do not call the continuance of the same fact an agreement; it is only when, amid difference of accompaniment, we recognize a common feature, that our attention is awakened, and our mind interested. Sometimes the common feature in a number of varying objects is obvious and universally noticed; as when we identify the round form amidst all disparities of size, color, and substance. At other times, the resemblance is so obscured by the amount of difference, that it has lain for ages unperceived; the fall of a stone was never suspected, before the time of Newton, to have anything in common with the motions of the moon and planets. When we see the same property or effect repeated under great variety of circumstances and adjuncts, and when we indicate by a name or otherwise that this agreement exists, we are said to mark out a *general* or generalized property, or fact; while the individual instances are termed the *particulars*, on which the other is grounded.

To understand the full meaning of generalization, and the questions therewith connected, we must advert to the distinction between two modes of the operation. In the one, we generalize an individual or isolated property—as roundness, whiteness, weight, attraction, justice—and assign what we think the exact nature of the common feature thus singled out. A number of designations have been given to this process, according to the particular stage in the operation most specially taken into view; these are classification, general notion, general term, definition, abstraction, concept or conception, idea. They all suppose that we have a plurality of objects with agreeing properties, and that agreement has been taken notice of, and embodied in such a form, that the mind can deal with it to the neglect of the points wherein the particular things differ among themselves. They suppose, further, that we make no affirmation beyond what is implied in the identifying of so many differing objects—namely, that they do agree in the point in question. No other matter for belief or disbelief is presented in the notion of roundness but that certain things have been compared, and have been found to agree in possessing that attribute. To attempt to form a general notion, or to mark a property not attaching to anything in nature, is a pure irrelevance and absurdity; and although by a bold stretch of imagination we might people the earth with chimerical objects, and find agreements among them, yet such generalities could not be introduced into any process of reasoning; it is presumed, that wherever a general property is specified, there are things in nature having this property in company with the others that make up the total characteristics of each.

But the other kind of generalization introduces belief in a totally different shape. When instead of identifying a property, we identify a union or *conjunction* of distinct properties, it has to be seen not merely whether the common features are correctly rendered in the general notion, but whether the alleged coupling always takes place. Thus,

when we compare the sea-coasts all over the globe, we find, with some exceptions, that twice a day the sea advances and recedes on the shore: this fact we express by the general name the tides. When, however, we go further, and note everywhere the *coincidence* between the tides and the positions of the moon, and generalize that coincidence, we attain to a more complicated result. We are now called upon to believe not merely in the accurate correspondence of a general notion with the particular objects, but in the constancy of the conjunction between two distinct properties, so that the occurrence of one shall always count as evidence of the other. The different aspects of this higher operation have given rise to another series of designations, contrasting with those given above for the simpler operation; these are induction, inductive generalization, conjoined properties, affirmation, proposition, judgment, law, order of nature. These all involve truth or falsehood, inasmuch as they all pretend to give us a positive assurance that wherever we find one thing we shall find some other thing present or absent, and be enabled thereby to anticipate our individual experience of the course of nature. A general notion can often be expressed in a single word; the *noun* is the part of speech that names both particular objects and general notions. A general proposition is a complete thought, and requires a sentence for its enunciation; it involves the *verb* along with the noun. Heat is a notion, and so is light; but when we unite the two in the affirmation that heat is the cause of light, we indicate something that is true or false, that may be proved or disproved, believed or denied.

This higher form of generalization is treated of under INDUCTION. On the other and simpler form, a few further explanations are added here. In the operation of forming a general notion, the first step is something of the nature of classification. We must assemble in our view a number of particular objects, being moved to bring them together by the attractive bond or association of similarity. The objects thus assembled are a class. In natural history, for example, we bring together in the mind all the quadrupeds that we have ever had any knowledge of, and the array constitutes a class, grounded on the peculiarity of walking on all-fours. Another class is made up of the animals that fly in the air: a third, of those that live in the sea. By such successive groupings of creatures that have a kindred nature, in one or more respects, we gradually include the whole of the animal kingdom known to us in a series of classifications, whereby method and order are introduced into the otherwise heterogeneous mass. So in plants and minerals, and all through nature. According as likenesses have been discerned in the constituent parts of the universe of things, the individuals are placed with those related to them, and a great simplification of view and extension of knowledge are the results. For it happens very frequently, that likeness in one point is accompanied with likeness in other points, so that we can couple several peculiarities together, and rise to general truths as well as general notions. When a classification has been arrived at that leads to this consequence, we put a more than ordinary value upon it; we consider that we have seized upon some fundamental and pregnant point of resemblance, something that conveys the most essential nature of the objects classified, and we are accustomed to style the group that so arises a *natural* or a *philosophical* classification. The arranging of animals according to the element they live in, as land, water, air, so very obvious to the first observers, has given place to one founded on other kinds of likeness—namely, the structure of the skeleton and the mode of bringing forth and rearing the young; it being proved that a greater number of important attributes are bound up with those characteristics than with the element that the animals inhabit. See Mill's *Logic*, book iv. chap. 7.

The forming of a class leads to the adoption of a class-name, in other words, of a *general name*, which is a name applicable to every individual member of the class, in consequence of being understood to express no more than they all have in common. Thus we have the name "round" to express all round objects, omitting any reference to other peculiarities that may attach to them. So the names "bird," "heath," "salt," are applicable alike to a vast number of individual things. When the general name has been devised, we can by means of it speak of all the particulars in one breath, on condition that we intend only to refer to the points of community.

The process called abstraction is further implied. When we bring together, or constitute a class, in virtue of a prevailing resemblance, we are said to "abstract" from the individuals everything else except the points of agreement. In the language of Sir W. Hamilton, we *attend* to the likeness, and *abstract* the differences. The notion that we have of the common quality is termed by the same philosopher the concept; but it has been usual to employ the phrase "abstraction," or "abstract idea" for the same purpose, although a perversion of the original application of that word. The common attribute of round bodies, the round figure, or form, is the concept, or the abstract idea of roundness. The precise character of this mental element or process has been much disputed in philosophy, there being three different sects that have grown up in connection with it; the Realists, Nominalists, and Conceptualists. The Realists gave an actual independent existence to the prototypes of our general notions, maintaining that, apart from all circular bodies, there existed in nature a circular *form*, having no other attribute soever, like a circle of Euclid bereft of the actual line required to mark the figure to the eye. The Nominalists considered that the only general thing was the common

name; the Conceptualists allowed a mental existence to the generalized attributes, but no more. (Sir W. Hamilton's *Metaphysics*, vol. ii. p. 296). The last are, no doubt, near the truth; for although we cannot, with Plato, affirm the existence in nature of "generals" that have no embodiment in particulars (which would be to contradict the very essence of generalization, namely, likeness *among unlikenesses*), we must still grant to the mind the power of attending in thought to what is common, neglecting for the time the disagreements. We can think of all the consequences of the circular figure, without specially attending to the other peculiarities of any individual circle. This abstractive process is performed in different ways, according to the nature of the subject. In geometry, for example, we can draw diagrams that are little other than naked forms, although we must make them of a definite size; and in contemplating these, we are enabled to think of form without substance. We cannot use this method in natural history; we cannot form a conception of a bird by a diagram that gives nothing but what is common to all birds. If we are reasoning upon the properties of the class, we may first call into view some one as an example, say a pigeon; from considering which, we can go so far as to note the common peculiarities of feathers, wings, bill, etc.; and when we have completed the description, we run over in our minds a number of other birds, to see that we have not mentioned points special to the pigeon. In fact, we must have within call the whole of the members of the class, if we would reason generally respecting it. After we have thus checked and corrected our generalized description, we can embody the abstract idea in a form of very wide occurrence in our general reasonings, namely, a verbal statement of the common attributes. By means of this, we may often dispense with the reference to the particulars, except to know the precise meaning of the language, which meaning is still some sort of general conception of the objects. We must have a general notion of feathers, and of the structure of the bill in birds, upon the plan above mentioned of holding in the mind some typical instance, subject to correction, by a comparison of all the instances coming under the genus. So that, in point of fact, no general reasoning has ever been invented to supersede totally this reference to the particulars; the formal reasonings of mathematics require us still to have in the mind concrete quantity, or one thing as equal to, greater than, or less than another.

These remarks lead us to the nature of definition, which is one of the important designations growing out of the operation of generalizing. To define, is to limit, settle, and specify the exact compass of the properties common to a class. Usually this is done by means of language; but in reality it is, and must be done, by a reference, direct or remote, to the particulars themselves. This reference frequently has the appearance of being dispensed with. The reason is that many general notions are compounded of others, and we can understand the composite notion from its components, without going further; that is, without producing particulars. Thus, a circle in the abstract might be made intelligible by pointing to a number of concrete circles, such as are drawn in Euclid; we should then have to impress on our minds a sufficient number of these to prevent us from ever associating with the general idea any one size, or any one color of the outline (which must be drawn in black, red, blue, or some other color). No one circle is really the general notion; this must be nothing less than a multitude of actual circles, which the mind apprehends by turns, so as to be sure of never affirming any attribute as common that is in fact peculiar to one or a few. But the concept, circle, can be got at in another way. If we determine first what is called a "point" in space, and a "line" proceeding from that point, and made to revolve around it, the other extremity of the revolving line will mark a course which is a circle. Here, if we possess ourselves of the simple notions or concepts, point, line, revolution, we may attain to the notion, circle, without examining actual circles in the concrete. So we may define an oval, or ellipse, and many other figures. This practice of referring to a simpler order of concepts for the constituents of a given one, is the main function of the definition, which applies, therefore, to complex notions, and not to such as are ultimate, or simple in the extreme degree. To define in the last resort, we must come to quoting the particulars. We cannot define a line by anything more elementary. To say, with Euclid, that it is length without breadth, is no assistance, as we must still go to our experience for examples of length; and length is not a more simple idea than line, being, in fact, but another word for the same thing. Nevertheless, it has been often supposed that there are general notions independent of all experience, or reference to particulars; the form commonly given to the foundations of the science of mathematics having favored this view.

The name "genus" is also connected with the present subject. It is co-relative with another word, "species," which, however, is itself to some extent a generalization; for every species is considered to have individuals under it. Thus, in zoology, *felis* is a genus of animals, and the lion, tiger, cat, etc., are among its species: but each of those species is the generalization of an innumerable number of individual lions, tigers, etc., differing considerably from one another, so that to express the species we are still obliged to have recourse to the operations of comparison, abstraction, and definition. Genus and species, therefore, introduce to us the existence of successive generalizations, more and more extensive in their range of application, and possessing, in consequence, a smaller amount of similarity or community of feature (see EXTENSION).

GENERAL LIEN, in English law, is the right which a party has to retain a chattel as security for the payment, not only of the particular article, but of any balance that may be due on general account in the same line of business. General liens do not exist at common law, but depend upon agreement, either express or implied, or upon the usage of trade. Thus, attorneys have a lien for the balance of their accounts over the papers of their clients. Bankers, factors, warehousemen, and others, have also a lien for the amount due to them on the general balance of their accounts. But it has been held that fullers are not entitled to this privilege, Rose *v.* Hart, 8 Taunt. 499. The right of wharfingers also is not clear in all cases, Holderness *v.* Collinson, 7 Barn. and Cres. 212. In regard to carriers, there has been much dispute whether, by the usage of trade, they have a general lien over goods intrusted to them; but the prevailing opinion appears to be that they have. The master of a ship has no lien on the vessel or her freight for his disbursements on her account; but now he has the same lien for his wages as a seaman has; 17 and 18 Vict. c. 104, s. 191. By 6 Geo. IV. c. 94, it is provided that any person in whose name goods are shipped shall be deemed to be the owner so far as to entitle the consignee to a lien for any advances made for the use of such persons, provided the consignees had no notice when the advance was made that they were not the true owners. As a lien rests upon the right to retain possession, it is lost by abandonment of the possession of the goods.

In Scotland, a similar right exists, under the title of retention. See also LIEN, and HYPOTHEC.

GENERAL OFFICER is an officer of the general staff of an army to whom is intrusted the command of a body of men. not less in strength than a brigade (q.v.). In an army of very large proportions, the normal sequence of command would be the following: the general commanding-in-chief, generalissimo, or field-marshal, would command the whole force; the generals would have separate *corps-d'armée;* the lieutenant-generals, wings of those *corps-d'armée;* the major-generals, divisions in the wings; and brigadier-generals, brigades in the divisions. In practice, however, an army is rarely large enough to allow of this exact scheme of a military hierarchy being strictly carried out.

In the British service, colonels become major-generals (except in cases of selection for very distinguished service) in order of seniority, provided each has served on full pay for a certain number of years; promotion to be lieutenant-generals and generals follows in exact order of seniority. From the last, promotion to the exceptional rank of field-marshal is conferred in rare instances by the special favor of the sovereign, who represents in person the sole command and possesses the patronage of all the land forces. In addition to the colonels who become effective generals, officers who have retired on half-pay at earlier periods of their careers rise by seniority to the rank of general officers; but they continue, notwithstanding, to receive only the half-pay of the rank in which they retired. With regard to remuneration, general officers hold 164 honorary colonelcies of regiments, worth, with few exceptions, £1000 each per annum, and the remainder receive *unattached* pay of £600 a year, if they have been in the guards; £1 6*s.* 8*d.* a day, if in the artillery or engineers; and £1 5*s.* a day, if previously in the line. This pay is received during non-activity, but when employed actively a general receives, in addition, £5 13*s.* 9*d.* a day; a lieutenant-general, £3 15*s.* 10*d*; and a major-general, £1 17*s.* 11*d.*, besides various allowances. The only generals' commands in the British service are, during peace, the commands-in-chief of the army generally and of the force in India, and sometimes in Ireland. In the estimates for 1876–77, there are 7 lieutenant-generals, 18 major-generals, and 5 brigadier-generals employed actively, exclusive of the numbers serving in India. The last-named rank is only a temporary one in the English service, conferred very commonly on the senior regimental officer of the corps composing the brigade: during duty as brigadier he receives £1 8*s.* 6*d.* a day in addition to regimental or other pay. *Captain-general* is a rank very rarely conferred by the sovereign, who holds it *ex-officio.* There has been no captain-general other than the sovereign, during the present century.

GENERAL OFFICER (*ante*), a term used with much license both in military and civil affairs. By a recent act of the United States congress the office of "general of the army," being the highest rank under the president (who is always commander-in-chief), was created. Besides brigadier and major-general we have lieutenant-general, commissary-general, quarter-master-general, etc. In the militia of the several states there are officers with similar designations and duties. In law we find the attorney-general of the United States, and similar officers in most of the states. The head of the powerful society of the Order of Jesus is known as the general. The French army has generals of division and lieutenant-generals.

GENERAL RULES OF THE METHODIST EPISCOPAL CHURCH, as recognized at the present day, are, with a few slight alterations, the rules drawn up by John Wesley for his first united society. The following are specimens of their design and scope: I. Each society is divided into classes containing about 12 persons, one of whom is the leader. It is his business—1. To see each of his class at least once a week in order to inquire how their souls prosper; to advise, reprove, comfort, or exhort them; and to receive what they are willing to give towards the support of the gospel. 2. To meet the minister and stewards of the society once a week in order to give the minister all

needed information; to pay to the stewards what he has received, and to show his account of the same. II. The members of the society are expected to give evidence that they continue to desire salvation—1. By doing no harm, and by avoiding evil of every kind, especially those forms most generally practiced. 2. By doing good, being merciful after their power, as they have opportunity; doing good of every possible sort, and, as far as possible, to all men. (Under these first and second divisions appropriate specifications of particulars are made.) 3. By attending on all the ordinances of God, such as public worship, the ministry of the word, the supper of the Lord, family and private prayer, searching the Scriptures, and fasting or abstinence.

GENERAL SHIP is a ship which has been advertised by the owners to take goods from a particular port at a particular time, and which is not under any special contract to particular merchants. The owners, in this case, engage separately with each merchant who applies to them to convey his goods to the ship's destination. The contract between the owners, or the master acting in their behalf, and the proprietors of the goods, may in the case of general ship be established by parole evidence, and, indeed, there is rarely any other writing on the subject beyond the advertisement and the bill of lading. In a general ship the master being intrusted by the owners with full power to contract for and take in goods, no agreement for freight which any one may have made with the owners, independently of him, will be effectual to secure room in the vessel. All such agreements must be intimated to the master, or those acting for him on board, before he has engaged freight for the whole vessel. By such intimation, a preference will be secured over the merchant who brings his goods to the ship's side on chance. If the owners of a general ship have advertised her as bound for a particular port, they must give specific notice to every person who may ship goods on board, of any alteration in her destination, and they will be liable for the consequences of neglecting to do so. Bell's *Com.* i. 433, Shaw's edition; Abbot on *Shipping*, p. 238.

GENERAL THEOLOGICAL SEMINARY of the Protestant Episcopal church in the United States. This institution was founded in 1819 at New Haven, Conn., shortly afterwards removed to the city of New York, and chartered by the legislature in 1822. It is governed by a board of trustees, composed of all the bishops of the church *ex-officio;* one trustee from each diocese, and one additional for every eight clergymen in the same; one more additional for every $2,000 of money contributed, until the same amounts to $10,000, and then one more additional for every $10,000. The faculty consists of a dean and such a number of professors as the trustees may from time to time determine. Any person who has been admitted as a candidate for holy orders, with full qualifications, according to the canons of the church, has the right of admission as a student. Others may be admitted on producing satisfactory evidence of moral and religious character, of classical and scientific attainments, of attachment to the church, and in general of such traits and dispositions as indicate a fitness for the ministry. No candidate is admitted without examination in the primary elements of the Hebrew language, in the Greek grammar, and in the Gospels and Acts of the Apostles, in order to test his preparation for entering upon a theological course of study. Candidates are also examined upon the rules and principles of English composition, and required to present a specimen of their proficiency in that department. The course of study extends over a period of three years, and opens on the Wednesday preceding the first autumnal ember day. Students pay nothing for tuition or room-rent within the seminary buildings, but they are expected to furnish their own rooms. Twelve scholarships, of the annual value of $150, are awarded by the professors, and several prizes are open to annual competition. The seminary occupies two substantial stone buildings, 50 by 110 ft., in 9th avenue and 20th street.

GENERAL VERDICT. See VERDICT, JURY.

GENERA'TION. See REPRODUCTION.

GENERATION. A term in use in mathematics. One geometrical figure is said to be generated by another, when produced or formed by an operation performed upon the other. Thus a cone is generated by making a right-angled triangle revolve about one of its sides adjoining the right angle as an axis. In arithmetic, in the same way, a number is said to be generated when produced by an operation performed on one or more other numbers. Thus, 36 is generated by the involution of 6 to the 2d power, or by the multiplication of 4 and 9.

GENERATION, ETERNAL. See TRINITY, DOCTRINE OF THE.

GENERATION, SPONTANEOUS. From the earliest period to the termination of the middle ages, no one called in question the doctrine that, under certain favorable conditions, of which putrefaction was one of the most important, animals might be produced without parents. Anaximander and Empedocles attributed to this form of generation all the living beings which first peopled the globe. Aristotle, without committing himself to so general a view, maintains that animals are sometimes formed in putrefying soil, sometimes in plants, and sometimes in the fluids of other animals, and lays down the following general principle, "that every dry substance which becomes moist, and every moist body which is dried, produces living creatures, provided it is fit

for nourishing them." The views of Lucretius on this subject are shown in the following lines:

> Nonne vides quæcunque morâ, fluidoque liquore
> Corpora tabuerint, in parva animalia verti?

And Pliny maintains that "quædam gignuntur ex non genitis, et sine ullâ simili origine." Virgil's directions for the production of bees are known to every reader of the *Georgics*, and an expression in the book of Judges (xiv. 14) probably points to a similar opinion.

Passing from classical times to the later period of the middle ages, and the two succeeding centuries, we may quote amongst the advocates of this theory Cardan—who, in his treatise *De Subtilitate* (1542), asserts that water engenders fishes, and that many animals spring from fermentation—Aldrovandus, Licetus, Gassendi, Scaliger, Van Helmont, who gives special instructions for the artificial production of mice, and Kircher, who in his *Mundus Subterraneus* (in the chapter "De Panspermia Rerum") describes, and actually figures, certain animals which were produced under his own eyes by the transforming influence of water on fragments of the stems of different plants!

Redi, the celebrated Italian naturalist, whose *Experiments on the Generation of Insects* were published in 1668, seems to have been the first opponent that the doctrine of spontaneous generation encountered. In this work, he proves that the worms and insects which appear in decaying substances are in reality developed from eggs, deposited in those substances by the parents. Leuwenhoek, Vallisneri, Swammerdam, and other eminent naturalists, soon contributed additional facts and arguments in favor of Redi's view; and as from the time of Redi to the present day, the tide of opinion has generally turned strongly against the doctrine in question, it is unnecessary to carry the historical sketch further.

The entozoa, however, continued to be a great stumbling-block. "When," says prof. Owen, "the entozoologist contemplated the *tænia* fixed to the intestine, with its uncinated and suctorious head buried in the mucous membrane, rooted to the spot, and imbibing nourishment like a plant—when he saw the sluggish *distoma* (or fluke) adhering by its sucker to the serous membrane of a closed internal cavity, he naturally asked himself how they got there; and finding no obvious solution to the difficulty of the transit on the part of such animals, he was driven to the hypothesis of spontaneous generation to solve the difficulty. It is no wonder that Rudolphi (1808) and Bremser (1824), who studied the entozoa rather as naturalists than physiologists, should have been led to apply to them the easy explanation which Aristotle had given for the coming into being of all kinds of vermes—viz., that they were spontaneously generated. No other explanation, in the then state of the knowledge of the development of the entozoa, appeared to be adequate to account for the fact of their getting into the interior cavities and tissues of higher animals." The recent investigations of Von Siebold, Küchenmeister, Van Beneden, Philippi, etc., regarding the development and metamorphoses of the entozoa, have, however, tended to remove nearly all the difficulties which this subject presented; and the advocates of spontaneous generation are fairly driven from this, one of the last of their battle-fields.

The only point at present in dispute is, whether microscopic organisms (animals or plants) may be spontaneously generated. It is well known that if we examine under the microscope a drop of water in which almost any animal or vegetable substances have been infused, and which contains the particles of such substances in a state of decay or decomposition, it is found to swarm with minute living organisms. The question at issue is this: Are these organisms developed in the water, if the necessary precautions have been taken to exclude every animalcule or germ capable of development both from the water and from the air that has access to it? A well-known experiment, devised by prof. Schulze of Berlin (a description of which may be found in Owen's *Lectures on the Invertebrate Animals*, 2d ed. p. 44), shows that with due precautions in reference to these points, no animal or vegetable organisms are produced. This experiment was continued interruptedly from May 28 until the beginning of August, "and when, at last, the professor separated the different parts of the apparatus, he could not find in the whole liquid the slightest trace of infusoria or confervæ, or of mold; but all three presented themselves in great abundance a few days after he had left the flask standing open." A vessel with a similar infusion, which he placed near the apparatus, contained vibriones and monads on the second day of the experiment, to which were soon added larger polygastric infusoria.

A few years ago M. Pouchet announced that he had repeated Schulze's experiment with every precaution, but that animalcules and plants were invariably developed in the infusion on which he operated. To prove that the atmospheric air contained no germs, he substituted *artificial* air—that is to say, a mixture of 21 parts of oxygen gas with 79 of nitrogen. The air was introduced into a flask containing an infusion of hay, prepared with distilled water and hay that had been exposed for twenty minutes to a temperature of 212°. He thus apparently guarded against the presence of any germs or animalcules in the infusion or in the air. The whole was then hermetically sealed, so that no other air could gain access; yet after all these precautions, minute animal and vegetable organisms appeared in the infusion. He repeated the experiment

with pure oxygen gas instead of air, and obtained similar results. These experiments are described by Pouchet in the *Annales des Sciences Naturelles* (1858, 4th series, vol. ix. p. 372), and the same volume contains important articles by Milne Edwards, and by De Quatrefages, in opposition to Pouchet's views.

A very large majority of our physiologists of the present day reject the doctrine; most of the apparently exceptional cases, as, for example, the mysterious presence of the entozoa, have been found to admit of ready explanation; and if we do not positively deny the possibility that animalcules may be generated spontaneously, we may at all events assert that such a mode of generation is not probable, and has certainly not been proved to exist. Those who wish to know more fully the arguments that may be adduced in favor of, and in opposition to, the doctrine, are referred, on the one hand, to Pouchet's *Hétérogénie, ou Traité de la Génération Spontanée, basé sur de Nouvelles Expériences* (1859); and, on the other, to Pasteur's *Mémoire sur les Corpuscles Organisés qui existent dans l'Atmosphere; Examen de la Doctrine des Générations Spontanées*, in the *Annales de Chimie et de Physique* (3d ser. 1862, vol. lxiv. pp. 1–110). The subject was discussed by prof. Huxley in his address to the British association in 1870.

GENERATIONS, Alternation of, a phrase devised by Steenstrup, a Danish naturalist, about the year 1840, to signify "the remarkable and till now inexplicable natural phenomenon of an animal producing an offspring, which at no time resembles its parent, but which, on the other hand, itself brings forth a progeny which returns in its form and nature to the parent animal, so that the maternal animal does not meet with its resemblance in its own brood, but in its descendants in the second, third, or fourth degree or generation; this always taking place in the different animals which exhibit the phenomena in a *determinate* generation, or with the intervention of a *determinate* number of generations."

The phenomenon has been observed in many of the *hydrozoa*, in various *entozoa*, in *annelids*, in *molluscoids* (*salpæ*), and in insects (*aphides*).

We commence with the development of the *medusæ* or *jelly fishes*, which belong to the class *hydrozoa*. The medusa discharges living young, which, after having burst the covering of the egg, swim about freely for some time in the body of the mother. When first discharged or born, they have no resemblance whatever to the perfect medusæ, but are little cylindrical bodies, covered with cilia, moving with considerable rapidity, and resembling infusoria. After moving freely in the water for some days, each little animal fixes itself to some object by one extremity, while at the opposite extremity a depression is gradually formed, the four corners becoming elongated, and gradually transformed into tentacles. These tentacles increase in number till the whole of the upper margin is covered with them. Transverse wrinkles are then seen on the body at regular intervals, appearing first above, and then extending downwards. As these wrinkles grow deeper, the edge of each segment presents a toothed appearance, so that the organism resembles an artichoke or pine-cone, surmounted by a tuft of tentacles. The segments gradually become more separated, until they are united by only a very slender axis, when they resemble a pile of shallow cups placed within each other. At length the upper segment disengages itself, and then the others in succession. Each segment continues to develop itself until it becomes a complete medusa; while the basis or stalk remains, and produces a new colony. Here, then, we have the egg of the medusa gradually developed into a polypoid organism, to which the term *strobila* (from *strobilos*, a pine-cone) has been given. This polype, by gemmation and fission, yields medusæ with reproductive organs.

The phenomenon of alternation of generations in the cestoid worms (q.v.), and in certain trematoid worms (see Fluke), has already been noticed, and will be further discussed in the article Tapeworms. The fission of certain annelids (Syllis and Myrianida), (see Reproduction), presents an example, although at first sight a less obvious one, of alternation of generations, the non-sexual parent worm yielding, by fissure, progeny containing spermatozoa and ova, from which again a non-sexual generation is produced.

The *salpæ* (*mollusca* or *molluscoids* belonging to the family *tunicata*) are usually regarded as affording a good illustration of the phenomenon under consideration. It was in these animals that it was originally noticed by Chamisso, who accompanied Kotzebue in his voyage round the world (1815–18). The salpæ (from twenty to forty in number) are united together by special organs of attachment, so as to form long chains, which float in the sea, the mouth, however, being free in each. The individuals thus joined in chains produce eggs; one egg being generally developed in the body of each animal. This egg, when hatched, produces a little mollusc, which remains solitary, differs in many respects from the parent, does not produce an egg, but propagates by a kind of internal gemmation, which gives rise to chains already seen within the body of the parent, which finally bursts and liberates them. These chains, again, bring forth solitary individuals.

The only instance in which this phenomenon occurs in animals so highly organized as insects, is in the *aphides*, or plant-lice. In many species of the genus *aphis*, which in the perfect state possess wings, a large proportion of the individuals never acquire these organs, but remain in the condition of larvæ. These without any sexual union

(none of them, indeed, being males) bring forth during the summer living young ones resembling themselves; and these young ones repeat the process, till ten or eleven successive broods are thus produced; the last progeny, toward the end of the summer, being winged males and females, which produce fruitful eggs that retain their vitality during the winter, and give birth to a new generation in the spring, long after their parents have perished. Other peculiarities of insect-generation will be noticed in the article PARTHENOGENESIS.

Several high physiological authorities, amongst whom we may specially mention Huxley ("On the Anatomy of Salpæ," in *Phil. Trans.* for 1851, and "On Animal Individuality," in *Ann. of Nat. Hist.*, 2d ser., vol. ix. p. 505), and Carpenter (*Principles of Comparative Physiology*, 1854), object to the term "alternation of generations." The detached portions of the stock, originating in a single generative act, are termed *zöoids* by these writers, whilst by the term *animal* or *entire animal* (the equivalent of *zöon*) they understand in the lower tribes, as in the higher, *the collective product of a single generative act.* Here they include, under the title of *one generation,* all that intervenes between one generative act and the next. "If," says Dr. Carpenter, "the phenomena be viewed under this aspect, it will be obvious that the so-called 'alternation of generations' has no real existence; since in every case the whole series of forms which is evolved by continuous development from one generative act repeats itself precisely in the products of the next generative act. The alternation, which is very frequently presented in the forms of the lower animals, is between the products of the *generative act* and the products of *gemmation,* and the most important difference between them usually consists in this—that the former do not contain the generative apparatus which is evolved in the latter alone. The generating zöoid may be merely a segment cast off from the body at large, as in the case of the *tape-worms* (q.v.), or it may contain a combination of generative and locomotive organs, as in the self-dividing *annelide.* It may possess, however, not merely locomotive organs, but a complete nutritive apparatus of its own, which is the case in all those instances in which the zöoid is cast off in an early stage of its development, and has to attain an increased size, and frequently also to evolve the generative organs, subsequently to its detachment; of this we have examples in the *medusæ* budded off from hydroid polypes, and in the aggregate *salpæ.*"—*Principles of Comparative Physiology,* p. 529.

GENESEE', a remarkable river of North America, rises about 10 m. s. of the boundary between the states of Pennsylvania and New York, flows n. through the western portion of the latter state, and after a course of 145 m. falls into lake Ontario, 7 m. n. of the city of Rochester. The Genesee is not only notable for the varied and romantic character of its scenery, but is also famous for its extraordinary falls. Of these falls, which are five in number, three, occurring within a distance of 2 m., in the vicinity of the town of Portage, about 90 m. from the mouth of the river, are respectively 60, 90, and 110 ft. high. The other two, the one occurring immediately above Rochester, and the other about 3 m. below that city, are both of about 100 feet.

GENESEE, a co. in s.e. central Michigan, on Flint and Shawassee rivers, crossed by the Flint and Pere Marquette and the Detroit and Milwaukee railroads; 648 sq.m.; pop. '74, 34,568. The surface is undulating and well wooded; soil fertile, producing wheat, corn, oats, hay, butter, wool, etc. Lumber is the principal article of export. Co. seat, Flint.

GENESEE, a co. in w. New York, intersected by the New York Central and four or five other railroads, drained by Tonawanda creek; 500 sq.m.; pop. '80, 32,042. The surface is mostly level, and the soil is exceedingly fertile. The main products are wheat, oats, corn, barley, fruit, butter, and cheese. Marl, muck, building-stone, and mineral springs abound. Co. seat, Batavia.

GENESEO, a village in Henry co., Ill., on the Chicago, Rock Island, and Pacific railroad, 159 m. w. by s. of Chicago and 23 m. e. of Rock Island. It is an important grain and stock-shipping point. It contains a national and a private bank, an iron-foundry, agricultural implement, tub and pail, furniture, wagon and carriage, cigar, and other manufactories; and two flour-mills. Besides a flourishing high school, there are several select schools, 3 newspapers, 11 churches, 3 hotels, and a large number of stores, saloons, etc. It is a thrifty, enterprising town. Pop. of v. 3,042.

GÉNESIS, or more fully GENESIS KOSMOU (origin, generation of the world), is the name first given by the Septuagint to the opening book of the Pentateuch. In the Hebrew canon it is called *Bereshith* (in the beginning), from the initial word; in the Talmud, it is sometimes referred to as "the book of creation," or "the book of Abraham, Isaac, and Jacob." Its Masoretic division into fifty chapters, followed in the English Bible, or into 12 large and 43 small encyclical sections (*Sedarim Parshioth*), has been grounded rather on convenience than on any corresponding division of the subject-matter. The book seems of itself to fall most naturally into two totally distinct parts: the first of which would extend from the beginning to the call of Abraham (c. i.-xii.), and embrace the account of the creation, paradise, fall, the generations between Adam and Noah, together with their religion, arts, settlements, and genealogy, the deluge, the repeopling of the earth, the tower of Babel, the dispersion of the human

race, and the generations between Noah and Abraham; thus forming an introduction to the second part (c. xii.–l.), or the history of the patriarchs (Abraham, Lot, Ishmael, Isaac, Jacob, Esau, and Joseph); the whole concluding with the settlement of Jacob's family in Egypt. Another division seems indicated by the inscription *Toledoth* (origin, generation), which occurs ten times in the course of the book, introducing at each repetition a new cycle of the narrative. and which would thus split the whole (from c. ii. 4) into ten distinct sections of disproportionate length.

The period of time over which the book of Genesis extends has been variously computed; the number of years commonly assigned to it is about 2,300, the variations in calculation seldom exceeding units or tens of years; bishop Hales alone, following the Septuagint, reckons 3,619 years.

Being a portion, and the introductory portion of the Pentateuch—at the same time that it forms a complete whole in itself—it cannot but be considered as laying down the basis for that theocracy of which the development is recorded in the succeeding books. While the design and plan of the Pentateuch is thus also that of Genesis, the latter, however discordant its constituent parts may seem, does not lack the necessary unity. Beginning with the cosmogony, or rather geogony, i.e., the generation of the earth with its animate and inanimate products, and all created things which bear upon and influence it visibly, the record gradually narrows into the history of man, and with the distinct aim of tracing the fate of the one chosen family and people, it singles out Noah, Abraham, Isaac, Jacob. The narrative dwells with careful minuteness upon their fortunes, laying especial stress on their intimate communion with God, and, with the three last, on the reiterated promises of the land which they should inherit: "they and their seed after them." The remainder of the human race is summarily treated of; the various founders of tribes and peoples that represent it being generally but briefly named. It is only in the case of brothers, or very near relations of the elect, that certain incidents of their lives are more fully recorded; plainly with the intention of proving the inferiority of their claims to divine consideration, or even of representing them as meet objects of the displeasure of the Almighty:—Ham, Ishmael, Esau. From c. xxxvii. to the end of the book, we have exclusively the one chosen family of Jacob and his children before our eyes; and the strictly national character, which the narrative now assumes, excludes everything but the fortunes of this particular house. Here, also, an unbroken, flowing style takes the place of the former apparently sketchy and sometimes abrupt manner. With the occupation by Jacob's rapidly developing tribe of the land of Goshen, this first great patriarchal period is brought to a fitting close, and the second ushered in, when the tribe reappears, after a lapse of time, as a people. The Maker of all things, having by the creation of one man and one woman placed all mankind on an equal footing, by his sovereign will, subsequently elected one righteous from out the mass of human corruption, and through this man's progeny—whose history is told at length—mankind is in the end to be reclaimed:—this seems the pith of the book, considered as a religious history of man.

A certain apparent difference of style and language; the occurrence of what seemed gaps on the one, and repetitions and contradictions on the other hand; the special headings (*Toledoth*) above mentioned; and, lastly, the different use of the term for the divine name, led very early to the question of the integrity of Genesis. Celsus, Isaac, C. Jasos, Aben Ezra, Karlsstadt, Spinoza, all assumed smaller or larger interpolations; that is, pieces evidently not written by the author of the book himself, but added afterwards. It was not before 1783 that the "hypothesis of documents," based on the alternate use of the word *Jehova* (everlasting) and *Elohim* (Almighty) was first broached. While the Talmud, Tertullian, St. Augustine, Chrysostom, Jehudah, Hallevi, etc., had all endeavored to explain how the individual word was always necessary in the special passage where it occurred, Astruc, a Belgian physician, published in that year his *Conjectures sur les Mémoires originaux dont il paroît que Moyse s'est servi pour composer le livre de Genèse*, in which he endeavored to show that this writer, or rather editor of the book, had made use of two large and ten small—respectively "Elohistic" and "Jehovistic"—documents for his composition. This theory was at first received with silent contempt in the writer's own country The only man who took any notice of it was Charban, who at the same time excused himself for refuting this "absurd but dangerous" theory. It soon, however, found its way to Germany, where it was warmly advocated and developed by Eichhorn (*Repert.* and *Introd.*), Ilgen, and Gramberg. A further step was taken by Vater and Hartmann, to whom belongs the "Hypothesis of Fragments," or of the whole Pentateuch being a mosaic of fragments by various authors. Both these notions have now been pretty generally rejected, chiefly on account of their incompatibility with the apparent unity of the whole work and its single parts. The theory adopted by the majority of biblical critics of our day, among whom may be mentioned Wette, Lengerke, Knobel, Stähelin, Bleek, Tuch, Delitzsch, and Bunsen, is the "complimentary," according to which the author of the Pentateuch—the Jehovist—had worked upon an old Elohistic fundamental record which embraced the time from the creation to the death of Joshua, altering, enlarging, and completely rewriting it. Ewald and Hupfeld, however, assume four writers; the former two Elohists and two Jehovists, the latter three Elohists and one Jehovist; while the apologetic school of Hengstenberg, Hävernick, Keil, attempts to uphold the primitive theory of one single author.

Considered from the remotest time as a book written under the influence of divine inspiration—a term very differently understood—and thus raised above all doubt as to its truthfulness, various efforts were made, from the days of the earliest interpreters to our own, to explain, by allegory and symbol, such of its statements as in their plain sense seemed incomprehensible to human understanding. Philo and the Alexandrines generally, Papias, Irenaeus, Justin Martyr, and others, in all seriousness spiritualized into divine parable that which was given as history; so much so, that St. Augustine—exemplifying the spirit of the times—shortly after his conversion, explains paradise to represent nothing more than the happiness of mankind, the four rivers the four virtues, the serpent the devil, the coats of skin immortality, etc. In more recent times, however, after Luther had restored the belief in the literal meaning of the text, some have gone so far as to refer all that is not within the grasp of human reason to the region of myth, and to point to the obvious similarity between the biblical narrative of the paradise, its four rivers, the serpent, the apple, the fall, etc.; and certain legends, common to most eastern nations in the remotest times, as a proof that they were all derived from one and the same mythical source. Since the revival of science in the 16th c., another and much graver difficulty, however, has arisen—viz., how certain distinct and explicit statements of the Scripture, allowing of but *one* translation, were to be reconciled with certain undeniable physical facts. It is more especially the Mosaic cosmogony, as contained in the opening chapters of Genesis, which has given rise to violent controversies. The age of the world, which, according to the Bible, would be 6000, or at most, between 7000 and 8000 years; its creation and the formation of the whole system of the universe in six days; have been declared by astronomers and geologists, who reckon the period of the existence of the earth by millions, of the universe by millions upon millions, to be subjects on which information must be sought elsewhere than in the Bible. Most of the apologists have to a certain degree granted this, and they only differ among themselves as to the extent to which the Bible, a book intended for religious instruction exclusively, has reserved such knowledge as has been or may be acquired by scientific investigation. The words of the biblical record themselves, so far from being in con tradiction to the results of human knowledge, are said to convey, if not directly, yet by implication all that science more plainly teaches. The two principal methods of reconciliation advanced in this country are those of Dr. Buckland and Hugh Miller (and their followers) respectively, the first of whom adopts and amplifies the Chalmerian interpolation of the geological ages before the first day (an opinion strangely enough to be found already in the Midrash (q.v.): "Before our present world, the Almighty had created worlds upon worlds, and destroyed them again"), the latter the Cuvierian expansion of the six days into geological ages. On the other hand, it is asserted both by those who hold that the Bible is entirely the work of man, and by those who take it as a mixture of the divine and the human element, that the biblical notion of the cosmogony, as well as of all the other physical phenomena, are simply in accordance with the state of science in the days when the book was compiled.

The apologists adduce, as a further proof of the authenticity of the Bible, the surpassing sublimity and moral superiority of its cosmogony as compared with all others. The dualism of God and matter, which, according to the different pagan systems, are either eternally co-existent or fused into each other, is exchanged for the awful and moving idea of a one personal God, who first created, then molded, and everlastingly sustains the universe, lavishing his highest gifts on man, made in his own image, and standing towards him in the living relation of a son to a father. The occurrence of similar traditions in the religious records of other primeval nations is taken as a corroborating proof of the historical truth of the biblical account. Recent investigations have likewise affirmed the division of mankind into three principal races, corresponding to Shem, Ham, and Japhet, to be substantially correct, as far as language is concerned.

The question whether Moses really was the author or compiler of Genesis has been negatived by some, chiefly on the ground that certain apparently obsolete names mentioned are explained by others which first came into use at a much later time, and that there are allusions made to events which happened centuries after Moses. Graves, Faber, Rosenmüller, and others, consider such passages to be late additions. The further question whether Moses wrote it while at Midian, or during the forty days on Mt. Sinai, or during the forty years' sojourn in the desert, will be considered in the article PENTATEUCH, where also some other points in connection with the composition of this book will be glanced at. Of opinions on the other side, we will briefly mention that of Lengerke, who holds the Elohist to have written under Solomon, and the Jehovist under Hezekiah; of Tuch, who places the former in the time of Saul, the latter in that of Solomon; and of Bleek, who assigns to the Elohist the time of Saul or the Judges, and to the Jehovist the beginning of David's reign

Of the infinite number of ancient and modern writers who have commented on Genesis, we will mention Cyril of Alexandria, Ephraem Syrus, Theodoret, Procopius, Chrysostom, Jerome, Augustine, Jitzchaki (commonly, but wrongly, called Jarchi), Aben-Ezra, Levi b. Gershom, Abrabanel, Mendelssohn, Michaelis, Vater, Bohlen, Rosenmüller, Eichhorn, Augusti, Faber, Graves, Schumann, Tuch, Knobel, Herder, Hamann, Baumgarten, Delitzsch, Hengstenberg, Keil, Kalisch, Kurtz, etc. See also Turner's and Hävernick's *Introductions to Genesis;* Hugh Miller's *Testimony of the Rocks;* Pye Smith's

Relation between Scripture and Science; Dr. Whewell's *Bridgewater Treatise;* Goodwin's *Mosaic Cosmogony,* etc.

GENESIS (*ante*)—the first book of the Pentateuch and of the Bible—of which the first words, signifying *In the beginning,* are used in the Hebrew as the title; and of this the Greek translation, *Genesis,* meaning origin or beginning, has been adopted in the Latin and English versions. With this title the whole book is found to correspond, so that it may be called an account of first things or of the beginning of things. It contains, I. *The beginning of the revelation concerning God.* His existence is the first fact announced after the mentioning of the beginning—"In the beginning, God." This, the earliest known written declaration concerning the being of God, was written in the midst of degraded and corrupting polytheism. II. *The account of the beginning of the creation.* 1. At the beginning, the distance of which in the past is not declared, the heavens and the earth were in their substance created. 2. In the narrative, brief as it is, we have recorded (see COSMOGONY) the beginning of motion, of light, of the atmosphere, of the separation of the land from the waters, of vegetable life, of the organized motions of the heavenly bodies, of animal life in the waters, in the air, and on the land, crowned with the beginning of the human race, created male and female, in the image of God, and appointed head over all creatures and all things on the earth. 3. There is also an account of the first dwelling-place provided for man, the paradise or garden of God, which, given, enjoyed, and lost, appears only in this first book, and is spoken of no more in the Bible, except as a reminiscence, until, in the last book, a promise is found that it shall be given again in the new creation to be enjoyed forever. 4. Immediately following the account of the creation of man there is the record of the first marriage, which is declared to be the model and law for all mankind. 5. And after the account of the finished creation is the record concerning the first Sabbath, a day of rest, instituted, hallowed, and blessed at the beginning, brought—as other books of Scripture show—into remembrance at Sinai, commanded to be observed throughout the history of Israel, made glorious at the beginning of Christianity, and spread abroad among the nations as an earthly rest, emblematic of heaven. III. *The account of the beginning of sin,* which is the substance of all that the Scriptures teach, and the sum of all that men know, concerning the entrance of that fearful and mysterious evil into the world. 2. Following this is the record of the first punishment inflicted which, terrible as it was, appears as the beginning of sorrows that thenceforth came on mankind in consequence of sin, concerning which the Bible has much to say until, in the last book, it promises a world which sin will never enter and in which, consequently, curse, sorrow, pain, and tears will not be known. 3. After the account of the beginning of sin is the record of the first death, of the first crime—the murder of the second born child by the hand of the first—of the growth of depravity until all flesh had corrupted their ways, filling the earth with violence; and, long after that, of the first of the historical series of battles which, beginning after the flood, has been continued to the present hour. IV. *The account of God's plan for checking the power of evil.* 1. By the deluge sweeping away transgressors in the consolidated strength of their iniquity, one family only being saved as the germ of the future race. 2. By preventing the aggregation of the renewed race through the confounding of their speech, so that they were scattered and weakened. 3. By cutting short the duration of life on the earth. At the beginning of the book the record is that men lived for nearly a thousand years; at the close it affirms that a man highly exalted for virtue, piety, and goodness lived only a little more than a century. Moses, the writer of Genesis, wrote also the lamentation concerning the common limit of human life, "the days of our years are threescore years and ten." At the present time in about half that term of years the chief part of a generation passes away. V. *The beginning of the plan of redemption.* 1. The first promise of a deliverer, "I will put enmity between thee and the woman, and between thy seed and her seed. He shall bruise thy head and thou shalt bruise his heel." The whole Bible develops this promise and records the fulfillment of it. 2. The first sacrifice, offered up after the entrance of sin, and, as other books of Scripture say, to be continued, multiplied, and completed by Christ offering up himself once for all. 3. The beginning of the history of redemption. The history, beginning with Adam, becomes conspicuous in Abraham and his descendants, constituting a chain of persons in whom the process of redemption was to be advanced, and through whom the promised redeemer was to appear. In the book of Genesis the descent is brought down to the tribe of Judah, and through the following books of the Old Testament it is continued until the New Testament records the coming of the Redeemer.

GENEST, EDMOND CHARLES, 1765–1834; b. near Paris. He was the brother of Marie Antoinette's friend, Madame Campan, but was himself a pronounced republican. In 1789, he was sent on diplomatic service to Russia, but two years later became most unpopular with Catherine II., and in 1792 was formally dismissed. He was appointed ambassador to Holland, but before setting out, he was asked instead to proceed as minister to the United States. Here he endeavored to rouse the people to a participation in the war between France and England, and even fitted out some privateers at Charleston. This, and the general imprudence of his behavior, induced Washington to demand his recall. He was formally recalled as minister, but remained in this country, became a naturalized citizen, and married a daughter of gov. George Clinton of New York.

GÊNET (*Genetta*), a genus of quadrupeds of the family *viverridæ*, nearly allied to the civets (q.v.), but having only a rudimentary odoriferous pouch, and claws perfectly retractile, as in the *felidæ*. The approximation to that family also appears in the vertical contraction of the pupil of the eye. The species are numerous; smaller and more slender animals than the civets, mostly natives of Africa and the warmer parts of Asia. One, the common genet (*genetta vulgaris*), is found in the south of Europe, as well as throughout Africa. It is gray, with small round or oblong black or brown spots; the tail, which is as long as the body, ringed with black and white. It frequents the banks of brooks. Its fur is a considerable article of commerce. It is easily domesticated, and is kept in houses in Constantinople to catch mice.

The GENET is sometimes met with in heraldry. There was an order of knighthood in France, founded by Charles Martel, called the order of the genet, but it has long ceased to exist.

GENEVA, a co. in s.e. Alabama, on the border of Florida, intersected by the Choctawatchie and Pea rivers; 550 sq.m.; pop. '70, 2,957—227 colored. The surface is level with sandy and unfertile soil. Corn, cotton, and pork are the chief productions. Co. seat, Geneva.

GENEVA, a canton of Switzerland in the s.w. of that country, is bounded on the n. by the canton of Vaud and the lake of Geneva, and on the s., e., and w., by the territories of France. It has an area of 109 sq.m., and in 1877 it had a population of 100,443, of whom near 50,000 were Catholics. It is watered by the Rhone and the Arne, which unite about two miles from the s.w. extremity of the lake of Geneva. The surface is hilly, and the soil, not naturally fertile, has been rendered so by the industry of the inhabitants. The political affairs of the canton and city have undergone various changes, the last of these being a revolution in 1847, when the old aristocratic party was overthrown, an da democratic and progressive party attained to power. Long inert, and in a backward condition, the administration is now most active in developing the resources of the canton. According to the constitution of 1847, all male citizens of 21 years of age exercise the right of electing representatives to the cantonal council; the age of members of which must be at least 25 years. There is a representative for every 666 inhabitants. The executive is confided to a council of state, composed of 7 members, nominated for 10 years, but eligible for re-election. The constitution guarantees civil and religious liberty, all forms of worship being allowed by law; but the majority of the citizens pertain to the Reformed Calvanistic church. The chief branches of industry are agriculture, and the manufacture of articles of *bijouterie* and watches. About 200,000 watches are made annually, and exported to France, England, Italy, and elsewhere. Musical-boxes, chronometers, mathematical instruments, etc., are also made. The chief town is Geneva (q.v.).

GENEVA, a village of North America, in the state of New York, is delightfully situated at the north-western extremity of Seneca lake, 200 m. w. of Albany, and 50 m. s.e. of Rochester. It is handsomely built, and commands a magnificent view of the lake and the surrounding country. Its principal institutions are the Episcopal church, a Gothic structure in stone; the Geneva medical college, and the Hobart free college. This institution, called the Geneva college till 1852, was established here in 1824, and had in 1872, 9 professors and 44 students. The Union public school and its four branches have 1200 pupils. Pop. '70, 5,521.

GENE'VA (Fr. *Genève*, Ger. *Genf*, Ital. *Ginevra*), the most populous and flourishing t. of Switzerland, capital of the canton of the same name, is situated on the southern extremity of the lake of Geneva, 70 m. n.e. from Lyon, in France. At the time of the contests between the Helvetii and the Romans, Geneva belonged to the country of the Allovrŏges. It was afterwards included in the Roman *Provincia Maxima Sequanorum*, and was a place of some importance under the Burgundian kings. On the dissolution of the kingdom of Burgundy, Geneva fell under the dominion of the Ostrogoths; in the year 536, under that of the Franks; and towards the 9th c., under the new kingdom of Burgundy. It had been mode a bishop's seat in the 5th c., and from the 12th c. continual feuds arose between the bishops and the counts of Savoy with regard to the supremacy. The citizens took advantage of these dissensions to obtain fresh liberties and privileges for themselves. In 1518, the Genevese concluded an alliance with Freiburg, and shortly after with Bern, and thus Geneva became a member of the Swiss confederation,

The doctrines of the reformation, boldly and enthusiastically preached by William Farel, met with general acceptance in Geneva. In conjunction with Bern, the citizens expelled the adherents of the dukes of Savoy—the so-called Mamelukes—from the town, and declared the bishopric vacant. In August, 1535, the Reformed religion was established by law; and in 1541, Calvin was invited to take up his residence permanently in Geneva, as public teacher of theology. It was he who chiefly impressed the stamp of rigid morality, not unalloyed with pedantry, on the minds of the citizens of Geneva, and awakened a taste for the exact sciences. The town, which had hitherto been merely a place of trade, thus acquired an important influence over the spiritual life of Europe, and became the center of education for the Protestant youth of Great Britain, France,

Germany and Spain. In 1602, the last attempt of the dukes of Savoy to recover the town was frustrated by the energy and resolution of the citizens.

During the 18th.c. Geneva was distracted by a continued feud between the aristocratic and popular parties, until in 1782, Bern, Sardinia, and, in particular, France, interfered in favor of the aristocracy. The French revolution led to a new crisis; the government was overthrown in July, 1794, equality in the eye of the law was established, a national convention appointed, and a reign of terror commenced. In 1798, Geneva and its territory was annexed to France under the name of the department "Du Lenan." After the overthrow of Napoleon, Geneva recovered its independence, and the cóngress of Vienna increased its territory considerably.

The situation of the town on both sides of the lake, where it is narrowed to a point and forms the Rhone, is exceedingly pleasant and advantageous for traffic. Formerly, Geneva was surrounded by walls, and consisted of clusters of narrow and ill-drained streets; but since the accession of the democratic party to power in 1847 (see next article), a most extraordinary change has been effected, and chiefly through the energy and enlightened views of M. James Fazy, a wealthy native proprietor. The ancient ramparts have been removed, streets widened and well paved, new and commodious quays constructed along the shores of the lake and river, and a spirit of improvement introduced which points to a great extension of the city. Among the latest improvements is the construction of a breakwater, within which, as in a harbor, steam-boats are received and lie in safety, and from which they depart several times daily to the principal ports on both sides of the lake. The two divisions of the town are connected by several wooden bridges, and by a handsome new stone bridge, which was completed in 1863. In rushing through the town, the Rhone parts into two branches, forming two islands, on one of which still exists an antique and picturesque cluster of buildings; on the other, laid out as a public pleasure-ground, there is a statue of Jean Jacques Rousseau, who was a native of the town. Stretching along a part of the new quay, on the left side of the Rhone, there is now a public promenade laid out as a *jardin anglais*. As forming a central terminus for French and Swiss railways, Geneva is a favorite resort of travelers, for whose accommodation there are several large and splendid hotels, commanding fine views of the lake and mountain scenery in the environs. The language spoken is French. The principal edifices are the cathedral church of St. Pierre, which dates from 1124; the town-hall; the college, founded by Calvin in 1558, and containing a library of 75,000 volumes; the Musée Rath, so called from the name of its founder, gen. Rath, and containing good pictures; the observatory, the finest in Switzerland; and the museum of natural history, containing De Saussure's geological collection, Haller's herbarium, the fossil plants of Brogniart and Decondolle, etc. The *academie* (originally established in 1368, and reorganized by Calvin and Beza in 1539) was raised in 1875 to the rank of a university by the addition of a medical faculty. Among the many handsome new public buildings may be mentioned the post-office, a Catholic and an English church, this last accommodating the large number of English residents and casual visitors. The staple manufactures of the town are watches, musical-boxes, and jewelery; and for the sale of these and other fancy articles, there are many attractive shops. Altogether, Geneva is to be considered as now one of the most prosperous and improving towns on the continent. In 1870, the population of the city and suburbs was 68,165.

GENEVA, Lake of, or the Leman Lake (*lacus Lemanus*, situated between Switzerland, to which the larger portion belongs, and the recently acquired territories of France. It lies 1150 ft. above the level of the sea, and extends for rather more than 50 m. from east to west, in the form of a crescent. Its greatest breadth is 8 m., and its depth between Evian and Ouchy is 920 feet. This lake at some periods of the year presents a curious phenomenon, which has never been sufficiently accounted for, the surface, especially near Geneva, rising and falling through a space of from 2 to 5 ft. in the course of about 25 minutes. The lake, which is never entirely frozen over, abounds in fish, and several steamers ply upon its waters. The shore on the side of the Pays de Vaud is celebrated for the beauty of its scenery; the southern French shore rises solemn and stern, with the mountains of Savoy in the background. From the Lake of Geneva, Mont Blanc is visible, and although 60 m. distant, is often reflected in its waters. The Rhone enters the lake at the upper end, turbid and yellow, and leaves it at the town of Geneva as clear as glass, and of a deep blue tint. The lake receives about 20 streams from its northern shore, none of which, however, are important.

GENEVA BIBLE (Bible, *ante*). During the reign of queen Mary, the work of providing an improved English version of the Bible was arrested in England, but received a new impulse among the exiles who fled to Geneva. Their New Testament was printed in 1557, and their whole Bible in 1560. In correct expression of the sense of the Hebrew and Greek originals, this version excelled all that had preceded it; and for 60 years it was in more general use than any other. At least 80 editions (of the whole Bible or of parts) were printed between 1558 and 1611. Among the reasons for its popularity may be mentioned: Its more portable size—small quarto instead of large folio—its use of Roman type instead of the black letter; its adoption of the division into verses; the Bible dictionary which was added to it, and helpful notes. Some of its peculiari-

ties are: It attempts to give the true form of Hebrew proper names; prints words not in the original in italics; gives a calendar of lessons which commemorates Scripture facts and the deaths of reformers, but ignores Saints' days; omits the Apocrypha; in the title to the epistle to the Hebrews, omits Paul's name, and in a note, treats the authorship as an open question.

GENEVA CONVENTION, an agreement concluded at an international conference which was held at Geneva 1864, under the presidency of general Dufour, the Swiss plenipotentiary, for the purpose of ameliorating the condition of the sick and wounded in time of war. The credit of originating this conference must be given to two citizens of Geneva, Dunant, a physician, who published a startling account of what he had witnessed in two military hospitals on the field of Solferino, and his friend Moynier, chairman of the society of public utility, who took up the idea of "neutralizing the sick wagons," formed associations for its agitation, and at length pressed it upon the governments of Europe, most of which sent representatives to the conference. The convention was drawn up and signed by them on the 22d of August, and since then it has received the adherence of every European power, and one Asiatic (viz., Persia). The convention consists of ten articles, of which the last two are formal. The others provide (1) for the neutrality of ambulances and military hospitals as long as they contain any sick; (2) for that of the staff; (3) that the neutrality of these persons shall continue after occupation of their hospitals by the enemy, so that they may stay or depart, as they choose; (4) that if they depart, they can only take their private property with them except in case of ambulances, which they may remove entire; (5) that a sick soldier in a house shall be counted a protection to it, and entitle its occupants to exemption from the quartering of troops and from part of the war requisitions; (6) that wounded men shall, when cured, be sent back to their own country on condition of not bearing arms during the rest of the war; (7) that hospitals and ambulances shall carry, in addition to the flag of their nation, a distinctive and uniform flag bearing a red cross on a white ground, and that their staff shall wear an arm-badge of the same colors; (8) that the details shall be left to the commanders. A second conference was held at Geneva on the same subject in 1868, and a supplementary convention drawn out, which, though not formally signed, has been acquiesced in by all the signatories of the original convention, except the pope, and which, while still unratified, was adopted provisionally by France and Germany in the war of 1870. It consists partly of interpretations of the former convention, and partly of an application of its principles to maritime wars. Its main provisions are these:—That when a person engaged in an ambulance or hospital occupied by the enemy desires to depart, the commander-in-chief shall fix the time for his departure, and, when he desires to remain, that he be paid his full salary; that account shall be taken in exacting war requisitions not only of the actual lodging of wounded men but of any display of charity towards them; that the rule which permits cured soldiers to return home on condition of not serving again shall not apply to officers, for their knowledge might be useful; that hospital ships, merchantmen having wounded on board, and boats picking up wounded and wrecked men shall be neutral; that they shall carry the red-cross flag, and their men the red-cross armlet; the hospital ships belonging to government shall be painted white with a green strake; those of aid societies white with a red strake; that in naval wars, any strong presumption that the convention is being abused by one of the belligerents shall give the other the right of suspending it towards that power till the contrary is proved, and, if the presumption becomes a certainty, of suspending it to the end of the war.

GENEVIEVE, a saint of the Roman Catholic church, the subject of many popular and highly poetical legends, and regarded with special veneration in France and particularly in Paris, of which city she is the patroness. From a nearly contemporary life of St. Geneviève, we learn that she was born in 422, in the village of Nanterre, near Paris, where, as a mere child, she attracted the notice of Germanus of Auxerre, who passed a night at Nanterre on his return from Britain in 429. Germanus is said to have marked her out as specially destined to a life of holiness and purity; and the child, partly from her natural tendency, partly, perhaps, under the influence of the counsel of so holy a bishop, devoted herself to a life of virginity and conventual seclusion. On the death of her parents, she was removed to Paris; and her active charity, and the extraordinary reputation for sanctity which she acquired both there and in other cities of France, which she visited on missions of Christian benevolence, won for her the admiring veneration, not alone of her own people, but even of the heathen or half-converted tribes, which, about this period, after a long series of struggles, had begun to amalgamate with the ancient population of the Roman province of Gaul. During the Frank invasion under Childeric, Geneviève, with her sisters in religion, set out on an expedition for the relief of the starving city, and successfully conveyed to Paris an abundant supply of provisions. The city, when taken, was treated with special leniency through her intercession with the king, and many captives obtained their liberty at her prayer. On the new alarm for the safety of Paris, created by the news of the march of Attila and his army of Huns, it was proposed to abandon the city; but Geneviève, assembling the matrons and consecrated virgins in one of the churches, exhorted them to avert, by prayer and fasting, the threatened calamity. The unexpected alteration of the direction

of Attila's march added still more to her reputation and to her influence; and it is agreed that her personal example, and that of the sisterhood to which she belonged, appealed, with no inconsiderable effect, to the natural sensibilities of the rude races which now found themselves, for the first time, in contact with the humanizing influences of the Christian religion. St. Geneviève enjoyed, to an extreme age, the reverence and love of the entire people. She died in 512 at the age of 89, and her memory is still affectionately described as the type of all that is purest and most elevating in the conventual life, as well as of all that is most admirable in the works of charity and benevolence, with which, in the active orders, that life is habitually associated. Under her patronage, and with her name, a religious congregation of priests was founded in the 12th c., which, with some vicissitudes, continued until the revolution. A religious congregation of women, under the name of "Sisters of St. Geneviève," was established in 1636, chiefly devoted to the care of the sick and the education of young females.

GENEVIÈVE DE BRABANT, b. 680; daughter of a duke of Brabant, sometimes called a saint. About the year 700 she was married to Sigfried, count palatine of Treves. During his absence with Charles Martel against the Saracens she was criminally solicited by Golo, a knight in whose charge her husband had left her. When Sigfried returned, he, finding that his wife had given birth to a child (which in reality was his own), ordered both mother and child to be killed. But their lives were preserved, and many years later, the repentant Sigfried found them out, and acknowledged the injustice of his suspicions. The existing ruins of a chapel built by Geneviève contain an altar on which some of the facts of her history are represented in sculpture.

GENGHIS (Jengueiz, Tchinggis, or Zingis) **KHAN**, originally called Temujin, a celebrated Mongol conqueror, b. Jan. 25, 1155 A.D., at Deylun-Yeldâk, near the northern bend of the Feramuran (Hoang-Ho), was the son of Yesukai Bahâdûr, a Mongol chief, who ruled over some thirty or forty families or clans, called the tribe of Neyrun, who dwelt between the Amur and the great wall of China, and paid tribute to the khan of East Tartary. On his father's death, he did not hesitate to assume the reins of government, though only 13 years of age. Some of the subject tribes refused to obey him, and chose another chief belonging to the same family. A war of several years' duration was the result, at the termination of which he was compelled to retire to Karakorum, the capital of Toghrul Ungh-Khan, monarch of the Keraeit, and place himself under that monarch's protection. Ungh-Khan gave him his daughter in marriage, and appointed him to the command of his army, in which capacity Genghis gave proof of great military talent, conquering the Mekreit, Tanjût, Jellâeir, and other neighboring tribes. But Ungh-Khan, becoming jealous of his growing reputation, and urged on by envious courtiers, ordered Genghis to be assassinated. The latter, having taken counsel with his relative and chief councilor, Karatchâr Nuyan, a youth of his own age, but renowned in Tartar history for his wisdom, resolved to depart for his native country, which, after many hairbreadth escapes, he reached at the head of 5,000 cavalry. Raising an army, he marched against his father-in-law; and Toghrul, vanquished in battle in 1203, sought refuge among the Naymans, but was slain by the guards situated on the frontiers. Genghis immediately seized upon Toghrul's dominions. In the following year, a number of Tartar tribes, alarmed at his increasing power, formed a powerful league against him. The command was given to Taï-Ungh-Khan, chief of the Naymans; but in a battle fought on the banks of the Amur, Genghis utterly routed his enemies, slew their leader, and became at once master of almost all Mongolia. Grander views of conquest seem now to have opened before his vision. In the year 1206, he convoked a kouriltai, or general assembly, on the banks of the Onan, a tributary of the Amur, flowing through his native land. This meeting was attended by deputies from all the subjugated hordes of Tartary, and Genghis contrived to obtain a religious confirmation of his designs. Up to this period he had borne the name of Temujin; but a renowned magician or priest, surnamed Bout-Tangri ("Son of Heaven"), venerated by all the Mongols, now came forward and pronounced him *Genghis Khan*—i.e., greatest of khans, or khan of khans, declaring that he should rule over the whole earth. The deputies were duly impressed. About this time the Eighurs, an agricultural and civilized people, inhabiting the country at the sources of the Hoang-Ho and Yang-tse-Kiang, voluntarily submitted to his sway. From this people, who professed Buddhism, the Mongols would appear to have acquired a knowledge of writing. They adopted the Eighur characters, but preserved their own language, and Genghis selected one of the newly-submitted tribe to instruct his children. The next important incident in his career was the conquest of the northern portion of China, called Khatai. The immediate cause of the war between Genghis and the emperor of China, Tchong-Hêi, was the refusal of the former to recognize the latter as his suzerain, or liege-lord. Most of the Tartar tribes which Genghis had subdued were really tributaries of the Chinese empire; and Tchong-Hêi, though not interfering to prevent the conquests of the Mongols, now wished Genghis to acknowledge his superiority by paying tribute. Genghis immediately prepared for war, scaled the great wall in 1211, and after a series of bloody and protracted campaigns, Pekin fell into the hands of the barbarians in 1215. Meanwhile Genghis was called back to Tartary to quell certain insubordinate tribes, headed by Gutchluk, son of the chief of the Naymans, who had recovered his ancestral dominions,

and also conquered those of the Gûr-Khân of Kara-Khatai. These tribes were nearly exterminated in a great fight which took place near the sources of the Yenissei. Gutchluk, however, had some time before taken refuge in Turkestân, a vast region stretching from lake Lob, in the middle of Tartary, westward to the sea of Aral. Here he succeeded in making himself supreme ruler, but only to be swept away by the victorious Mongols, now pressing westward in an irresistible torrent. At length Genghis reached the Sihoon, the north-eastern boundary of the empire of Khaurezm or Kharism, whose ruler, Ala-ed-din Mohammed, was one of the most powerful sovereigns in Asia. The dynasty to which he belonged had risen into power through the weakness of the Seljuk sultans; and its sway now extended from the borders of Syria to the river Indus, and from the river Sihon to the Persian gulf. The murder of some Mongol merchants at Otrâr, a town on the Sihon, afforded Genghis a pretext for invasion. He immediately dispatched his eldest son, Jûjy, at the head (according to eastern chroniclers) of 700,000 horse, who accordingly burst into Khaurezm in 1219; and after having overthrown the Tartar allies of sultan Mohammed, and fought a long and bloody battle with the sultan himself with no decisive result, captured Samarkand, Bokhara (the valuable library of which he destroyed). and all the other important cities of the country. The Mongols, in three separate divisions, now scoured and ravaged Khaurezm in all directions. In the course of five or six years, they overran the whole of Persia, subdued the inhabitants of the Caucasus, crossed into Russia, and plundered the land between the Wolga and the Dnieper. Nor were they less successful in the east; the whole of southern Asia, as far as the Sutlej, experiencing the miseries of their devastations. Sickness, disease, and exhaustion at length enfeebled the Mongol hordes, and compelled Genghis to return to Karakorum, in Tartary, the capital of his empire, in 1224. During his absence, his generals had been prosecuting the Chinese war with the greatest success. Genghis, though well advanced in years, was still possessed by the old thirst of conquest; and having recruited his forces, he led them across the great desert of Gobi to the kingdom of Tanjout, in the n.w. of China, the capital of which, Nin-hia, he besieged. Disheartened by the loss of the greater part of his army, the king of Tanjout promised to capitulate at the end of a month; but in the interval Genghis died, Aug. 24, 1227, on the hill Liou-pan, worn out with years and toils. Genghis is said to have had five hundred wives and concubines, and to have left a great number of children, among three of whom he divided his enormous possessions. The third son, Oughtai, was appointed "Grand Khan," and received for his share the country now called Mongolia, with Khatai or Northern China as far n. as the mouth of the Amûr. The second son, Tcheghatai, received Turkestân n. of the Amû or Jeyhûn, and was committed to the guardianship of Karatchâr Nuyan. Jûjy, for his share, obtained Keptchâk, and all the country w. and n. of Turkestân, an immense tract extending from the Caspian sea almost to the Northern ocean.

In the course of his sanguinary career, Genghis is said to have destroyed, by wars and massacres, no fewer than five or six millions of human beings. His conquests were generally accompanied with acts of appalling barbarity, yet we seem to trace through the dreadful history of the man some indications of a civilizing tendency. Himself a monotheist, a stern believer in God after the fashion of Mohammed, he nevertheless tolerated all religions; exempted from taxes and military service physicians and priests; made obligatory the practice of hospitality; established severe laws against adultery, fornication, theft, homicide, etc.; organised a system of postal communication throughout his enormous dominions (mainly, no doubt, for military purposes); and so thoroughly organised what we may call the police or civil authority, that it was said one might travel without fear or danger from one end of his empire to the other. He would also appear to have had a respect for men of learning and virtue, and to have retained several of such about his person. The only memorial of Genghis now known to exist is a granite tablet, with a mongol inscription (deciphered by Schmidt of Petersburg), discovered among the ruins of Nertschinsk. This tablet had been erected by Genghis in commemoration of his conquest of the kingdom of Karl-Khatai.

GE'NII. According to the belief of the old Italian races, genii were protecting spirits, who accompanied every created thing from its origin to its final decay, like a second spiritual self. They were appropriated not only to men, but to all things animate and inanimate, and more especially to places. They were regarded as effluences of the Divinity, and were therefore worshipped with divine honors; sacrifices were annually made to them on various occasions, especially on birthdays, and during the period of harvest. Nay, Jupiter himself was called the genius of men, and Juno of women. Not only had every individual his genius, but likewise the whole people. The statue of the national genius was placed in the vicinity of the Roman forum, and is often seen on the coins of Hadrian and Trajan. The genius of an individual was represented by the Romans as a figure in a toga, having the head veiled. and the cornucopia or patera in the hands; while local genii appear under the figure of serpents eating fruit set before them. (Compare Hartung *Die Relig. der Röm.* 1 p. 32. etc., and Schömann *De Diis Manibus, Laribus, et Geniis*, Greifswald, 1840.)—The GENII of the east bear no resemblance to the old Italian genii. Their proper Arabic name is *djinn* or

jinn; and there seems to have been no better reason for translating the word by the Latin term *genius*, than the casual similarity of the sounds. The word djinn is from an Arabic root, signifying to "veil" or "conceal," and properly denotes an "invisible being." The djinns, or eastern genii, are, in fact, regarded by the Arabs and Persians as an intermediate class of beings between angels and men, and inferior in dignity to both. They are described in poetry as the subjects of a certain Ján Ibn Ján, and as inhabiting the world before the present race of human beings; but they having excited the anger of God by their rebellion, he sent his favorite angel, Hháris, or according to others, Azazel, to punish and govern them. Some time after, Hháris himself rebelled, whereupon God condemned him to eternal punishment. From this period, on account of his despair or his apostasy, he was called Eblis or Iblis. The djinns can assume, in an instant, any form they please, whether of man, brute, or monster; the last—in accordance with the popular view of their wicked character—being the one most frequently selected. Such as have read the *Arabian Nights* will have a vivid recollection of the hideous and gigantic shapes under which the genii are wont to manifest themselves, accompanied at times with smoke and thunderings, to terror-stricken mortals. They are in no degree whatever *guardian* spirits like the genii of the old Italians; on the contrary, they are inimical to man's happiness, and can only be subdued by the spells of powerful magicians. See FAMILIAR SPIRITS. The better-informed easterns, however, do not believe, it is said, in the actual existence of such beings. The Mussulman doctors, it is true, affirm the existence of djinns as an invisible race of supernatural beings, who carry out the purposes of deity, but they reject altogether the grotesque and repulsive inventions of the Arab and Persian romances and poets.

GENIPAP, a much esteemed fruit of the West Indies and warm parts of South America. The tree which yields it is *genipa Americana*, of the natural order *cinchonaceæ*. It is a 2-celled berry, containing many seeds; about as large as an orange, of a whitish-green color, with a dark purple juice of an agreeable vinous taste.

GENIS'TA, a genus of leguminous plants, of which the characters are noticed in the article BROOM. Some of the species are popularly known by the name broom, some as GREENWEED (q.v.). *Genista Anglica*, a much branched, very spiny shrub, not above a foot high, is called PETTY WHIN and NEEDLE FURZE in England, where it is regarded as indicating a very poor soil. The *genista* of Virgil and other Roman classics is supposed to be *genista Hispanica*, a native of the south of Europe, with branched stiff spines. *Gen* is said to be a celtic word, signifying a shrub. The name plantagenet, is from *planta genista;* but what plant was intended, and whether the common furze or a species of *genista*, is not so certain.

GE'NITIVE, the name of one of the "cases" in grammar (see DECLENSION). In such an expression as (Lat.) *regis filius*, (Eng.) the *king's son*, the form *regis* or *king's* is called the genitive case; and according to the usual explanation, this name was given it, because it indicates the source or origin of the thing joined with it. A much more satisfactory account of the origin of the name, and of the real nature of the genitive case, is that given by Max Müller (*Science of Language*). The terms of grammar were originally applied, not to the parts of speech, but to the elements of thought; they were logical terms before they were grammatical. Long before the now familiar grammatical distinctions of singular and plural, of gender, case, voice, etc., had been thought of, the Greek writers on dialectics, in analysing the different parts of an expressed thought, had distinguished the principal notion—the subject or nominative as it is called—from secondary or dependant notions; the dependency of the latter they expressed by the word *ptosis* (Lat. *casus*), a fall or leaning of one thing upon another; and in such a proposition as, "the king's son is dead," they indicated the exact nature of the dependence by calling it the *genikē ptosis*, i.e., the case showing the genus, kind, or class—the generic case; for while the name "son" is applicable to every man having parents, "king's son" is limited to the class of sons having kings for their fathers. One name joined to another in this relation has thus the same effect as an adjective (q.v.) in limiting its application. It seems probable, indeed, that the termination of what we now call the genitive case, was originally the same as that by which adjectives were formed from nouns. The names thus applied to ideas were by the Greek grammarians of Alexandria transferred to the words expressing them, and were afterwards translated into their Latin equivalents by the Greek grammarians who taught their language to the youth of Rome. But by this time the terms had become strictly technical, and their original signification little thought of; and this may account for the Greek *genike*, the Latin equivalent for which is *generalis*, being rendered by *genitivus*, generating or producing, which would have been expressed in Greek by *gennetikē*.

In English, the genitive is the only case or relation among nouns expressed by a difference of termination, and even it is often expressed by the proposition *of;* as the *river's* brink, or the brink *of the river*. From the frequency with which the form in *'s* indicates that one thing belongs to another, it is often called the *possessive* case. But this name is little applicable in such expressions as a *day's* journey; still less in many cases where the genitive is used in the ancient languages; e.g., *fons lactis*, a fountain of milk. The *generic case*, however, meaning that which limits the other noun to a class or kind, will be found to express the real relation in every conceivable combination.

The termination *'s* has been erroneously supposed to be a contraction for *his*, as if "the king's son"="the king his son." But this would not account for "the queen's son," or for "men's sons." Besides *his* itself is the genitive of he, and formed in the same way as king's, for the apostrophe (') is a mere artificial expedient of writing to distinguish the possessive from the plural, and does not belong to the spoken language. The English genitive in *'s* is a genuine relic of the inflections (q.v.) common at an early stage to all the Aryan languages. *s* was the prevalent ending of the genitive singular in the Anglo-Saxon, and in modern English it has been extended by analogy to all nouns and even to the plural. When the plural ends in *s*, the additional *s* of the genitive is omitted, for the sake of the sound, as king's sons.

GE'NIUS. This word, which conveys the most lofty eulogium that can be applied to intellectual excellence, meant originally the tutelary god or demon that was anciently supposed to preside over the birth and destinies of every individual human being. The peculiarities attending the character and career of each person came thus to be attributed to the higher or lower nature of their attendant genii. Thus arose one of the meanings now attached to the word—namely, the special bent, aptitude, or faculty, which any one possesses; as a genius for poetry, for music, for mathematics, for statesmanship, and so forth. But this is not the chief or most prominent idea implied in the usual application of the term. If we consult usage, we shall find that genius is more frequently spoken of in connection with the poet, painter, architect, etc., than with the man of science or of practice; as if there was something in the regions of fine art that came more directly home to the susceptibilities of men, and evoked their expressions of admiration and praise. And such is really the case. The artist's function is to touch immediately the chords of human pleasure; the men of practical life, the physician, lawyer, or engineer, have more to do with the deliverance from pains or from obstacles to pleasure, and however necessary their work may be, it is apt to be associated with the dark and gloomy side of our human life.

Undoubtedly, the most important meaning of the term, as pointing to a fundamental peculiarity in which human minds differ, is that connecting it with originality, invention, or creative power, in any department of intellectual activity, artistic, scientific, or practical. Not poetic creativeness alone, but every effort of the inventive faculties of man, by which new and superior combinations and devices are introduced into the world with a view to diminish the pains and add to the pleasures of mankind, may be properly designated "genius." Sufficient authority exists for this more extended use of the word, and we may justify it also by the consideration, that there is a common fact in all these different modes of intellectual superiority, while it is further possible that there may be a common foundation for them all in the constitution of the mind. We mark off the department of original power from other departments or modes of the intellect, still of positive value and of real importance—namely, the powers of acquiring and reproducing what has been already produced. Amassed learning, extensive acquisitions in science, educated skill in the common arts or in fine art, may exist in a high degree, and may even confer distinction on the individual and serve useful purposes in life, without the accompaniment of originality. The praise implied in the name "talent" would be conceded to the best examples of acquired power, short of the aptitude for invention. This furnishes the most respectable contrast to genius, being itself something admirable and meritorious. A less esteemed contrast is furnished by the crowd of *imitators* that follow in the wake of any great and original mind, who aim at producing similar effects without the inward spontaneity of the master, and with only the resource of copying his external form and peculiarities. There is a kind of ability amounting to talent in this power of imitation, and literature always contains both good and indifferent examples of it. We are accustomed to speak of poetasters, playwrights, and copyists, among the writers of every literary period. The imitators of Homer in his own time have not survived; but he, as well as every other great genius, may be tracked in subsequent compositions. Spenser's school of poetry makes the largest section of the published poems of the century succeeding him. Pope impressed his style upon last century; and Johnson's balanced prose continued to be reproduced long after his death.

The meaning of genius being thus understood as referring to original creativeness, or inventive power, it has been considered a problem of interest to trace it to its foundations in the mind, with a view to determine whether it be a distinct faculty, or only a superior degree of other recognized powers. Johnson's definition is well known; "large general powers turned in a particular direction." This negatives the idea of a specific endowment, and would seem to imply that the man of genius could be anything that he pleased; that Aristotle might have been Pindar, and Homer have discovered the forty-seventh of Euclid; an assumption in the last degree improbable, if not verging on absurdity. There is a class of minds noted for versatility, but they are only a select class. Cæsar was a general, an orator, and a writer, besides being a politician of mark, whether successful or unsuccessful. But, according to the most enlightened theories of the present day, it is usual to consider human beings as born with distinctive endowments; and although there is a common mental organization at the basis, yet this is supposed to have a plurality of distinct functions, any one of which may rise in degree

without the rest. Thus, intellect may be powerful on the whole, without involving a proportionate intensity of the feelings or the volition; the sensibility of the ear may be acute, and that of the eye only average. Now it would be fair to suppose that genius in one line—as, for example, painting—would result from the unusual augmentation of the susceptibilities and powers specially exercised in the art; the sense of color and of form, skill of hand, and a good recollection of those objects of nature and human life, that are the fitting material of a painter's compositions. So a poet should have a more than common ear for verse, plenty of language, taste for the appropriate images of poetry, and so on. In this way we might, by a kind of analysis, determine which of the faculties common to all men should be exalted to a superior pitch, in order to furnish a genius in each separate walk. This method has been pursued by the phrenologists and by other speculators, and is probably now the received mode of handling the subject. Examples may be seen in Bain on the *Study of Character*.

GENLIS, Stéphanie Félicité, Comtesse de, was b. at Champçéri, near Autun, in Burgundy, Jan. 25, 1746, of an ancient but reduced family. Her maiden name was Ducrest. At the age of 15 she was married to the comte de Genlis; and in 1770, through the influence of her aunt, Madame de Montesson (who had been privately married to the Duc d'Orleans), was made a lady-in-waiting in the household of the Duchesse de Chartres. In 1782, the Duc de Chartres, afterwards known as Egalité, appointed her "governor" of his children. This appointment gave rise to certain scandalous reports, the truth of which subsequent circumstances appear to have confirmed. Madame de Genlis wrote a variety of works for her pupils, among others, *Théâtre à l'usage des jeunes personnes, ou Théâtre d'Education* (Paris, 1779–80); *Adèle et Théodore, ou Lettres sur l'Education* (1782); and *Les Veillées du Château, ou Cours de Morale, à l'usage des Enfants*. On the breaking out of the revolution, Madame de Genlis took the liberal side, but was ultimately compelled to seek refuge in Belgium. Afterwards she went to Switzerland, and in the same year proceeded to Altona, in Germany, where she wrote a romance, entitled *Les Chevaliers du Cygne, ou la Cour de Charlemagne;* and also *Précis de la Conduite de Madame de Genlis pendant la Révolution*, as a sort of reply to the accusations of her numerous enemies. When Bonaparte became consul, she returned to Paris, and received from him a pension. From this time she resided constantly in Paris, publishing in rapid succession one book after another, till her death, Dec. 31, 1830. Madame de Genlis's writings amount to about 90 volumes. They are chiefly descriptions of incidents in fashionable society, with which she was thoroughly acquainted, and which she painted in lively colors. As she advanced in life, her writings became more and more polemical and ill natured. Her *Observations Critiques pour servir à l'Histoire littéraire du 19me siècle* (2 vols. Paris, 1818); and her *Dictionnaire Critique et raisonné des Etiquettes de la Cour, des usages du Monde*, etc.; and her *Dîners du Baron d'Holbach*, subjected her to severe criticism. The last of these contains a great deal of curious but malicious information concerning the freethinkers of the 18th century. Nevertheless, her writings have been very popular, and have passed through several editions. Her voluminous *Mémoires* were written after she had reached her 80th year.

GENNADIUS. Georgius Scholari or Scholarius, better known as Gennadius, a learned Greek and for some time patriarch of Constantinople, obtains a place in history through the important part played by him in the contest between Platonism and Aristotelianism which marks the transitions from mediæval to modern thought. Extremely little is known of his life, and so contradictory are some of the accounts bearing on detached facts in it that it has often been supposed that there were two writers of the same name living at the same period. Scholarius first appears in history as assisting at the great council held in 1438 at Ferrara and Florence with the object of bringing about a union between the Greek and Latin churches. At the same council was present the celebrated Platonist, George; Pletho Gemistus, the most powerful opponent of the then dominant Aristotelianism, and consequently the special object of reprobation to Gennadius. In church matters, as in philosophy, the two were opposed—Pletho maintaining strongly the principles of the Greek church, and being unwilling to accept union through compromise, Gennadius, more politic and cautious, pressing the necessity for union, and becoming instrumental in drawing up a form, which from its vagueness and ambiguity, might be accepted by both parties. It would seem that at Florence Pletho published the work on the difference between Aristotle and Plato, which afterwards called forth a reply from Gennadius. Of this reply only the arguments quoted by Pletho in his counter-argument have been preserved. They show that Gennadius, though Aristotelian throughout, had an accurate knowledge of Aristotle, and was more moderate than some of his contemporaries, *e.g.*, George of Trebizond. The next appearance of Gennadius is in 1453. After the capture of Constantinople by the Turks, Mahomet, finding that the patriarchal chair had been vacant for some time, resolved to elect some one to the office. The choice fell on Scholarius, who is described as a layman. While holding the episcopal office, Gennadius drew up, apparently for the use of Mahomet, a symbol or confession of faith, which is very valuable as the earliest expression of the principles of the Greek church. He also at this time had the pleasure of condemning to the flames the great work of his old opponent Pletho, the treatise on *Laws*, of which considerable fragments have come down to us. After a short period of office at Con-

stantinople, Gennadius is said to have resigned the episcopal dignity and to have retired into a convent.

GENNES'ARET, SEA OF, called also in the New Testament, *The Sea of Galilee*, and *The Sea of Tiberias* (from the city of Tiberias), and in the Old Testament *The Sea of Chinnereth* or *Cinneroth*, from an ancient town of that name situated on or near its shores. The word Gennesaret itself is supposed by some to be merely a corruption of Chinnereth; but others derive it from *Gannah*, a "garden," and *Sharon*, the name of a plain, between Mt. Tabor and the lake. The sea, or rather, lake of Gennesaret is about 13 m. long and 6 broad. It lies in the bottom of a great basin, and is undoubtedly of volcanic origin. Although the Jordan runs into it red and turbid from the n., and many warm and brackish springs also find their way thither, its waters are cool, clear, and sweet. Its shores are also enlivened with sparkling pebbles. Now, as formerly, it abounds in fish; but the fisheries are almost entirely neglected. The surrounding scenery is not very beautiful, but its associations are among the most sacred in Palestine. "Where'er we tread, 'tis haunted, holy ground." "Like Jerusalem, the sea of Gennesaret is enshrined in the heart from childhood. The home of Christ—'his own city'—Capernaum, lay on its shores; many of his miracles were performed around and upon it; he taught the multitudes that followed him, on the heights over it, along its pebbly beach, and from a boat on its surface; most of the apostles were fishermen, who here gained their daily bread; and one of Christ's last earthly interviews with them, after the crucifixion, was on that occasion when, driven probably by necessity, they had temporarily resumed their old occupation, and had toiled a long night without success" (Porter, *Handbook for Syria and Palestine*, part ii. page 418). In the time of Christ, the region round about was the most densely populated in Galilee. Nine cities and towns stood on the shores of the lake, while the neighboring plains and eminences were dotted with numerous large villages. Of the nine cities, seven are now uninhabited ruins; half a dozen mud-hovels are sufficient to house all the human life at Magdala, and only Tiberias continues to exhibit some feeble traces of its former prosperity.

GENOA, a n.w. province of Italy on the gulf of Genoa, 1588 sq.m.; pop. '72, 716,759. It is divided into four districts, forming a strip of coast land around the gulf and embracing the former duchy of Genoa. The rivers rising in the Apennine chain are short in their course. The surface is rough, and agriculture little advanced. Vines and olives, however, abound, and much fruit is exported. Silver, copper, lead, manganese, coal, and slate are found. A railroad parallel with the great highway known as the Cornice road, skirts the coast.

GEN'OA (Ital. *Genova;* Fr. *Gênes;* anciently, *Genua*), a city of Italy, situated on the Mediterranean gulf of the same name, at the foot of the Apennines, 79 m. s.e. of Turin, is the chief commercial seaport of the Sardinian provinces. Lat. of light-house, 44° 24' 18" n., long. 8° 54' 24" east. The pop. of the town of Genoa in 1872 was 130,269; that of the province of which it is the capital, 716,284.

From the sea the aspect of Genoa is a splendid panorama; the slopes of the hills down to the shore are covered with palaces, churches, hotels, and private dwellings, relieved by terraced gardens and groves of orange and pomegranate trees; while the bleak summits of the loftier ranges are capped with forts, batteries, and outworks, which constitute a line of fortification of great strength and extensive circuit.

The fine harbor, of which the diameter is rather less than a mile, is semicircular, and formed by two piers, at the extremity of one of which stands a light-house tower, 300 ft. high. Vessels of the largest class can enter inside the harbor, and, notwithstanding the heavy swells occasioned by s.w. winds, the harbor is remarkably safe. As yet, however, there is no landing-pier for passengers, all of whom, at considerable inconvenience, are carried ashore a distance of nearly half a mile in row-boats. Subject to this drawback, the harbor is visited daily by French and Italian steamers in communication with other ports in the Mediterranean. There is railway communication between Genoa and Turin, Arona, Alessandria, Nice, etc. In 1873, a new line of railway along the coast was completed to Spezzia, and is in progress thence inland to Parma and Modena.

Several important establishments are grouped round the port—viz., the arsenal, the convict prison, the custom-house, and the *Porto Franco* or free-port warehouses, where merchandise may be stored previous to its re-exportation free of duty. Genoa is the great commercial depot of a wide extent of country, of which the chief raw exports are olive oil, rice, fruits, cheese, steel, etc.; the manufactured goods exported are velvets, silks, damask, gloves, flowers, paper, soap, jewelry in silver and coral, in all of which industrial branches the excellence of the Genoese workmen is incontestable. The imports are principally cottons, raw cotton, woolens, cochineal, indigo, grain, hides, etc. The annual exports of Genoa are valued at £4,000,000, while the imports are returned at £10,000,000.

While strikingly grand as viewed from the sea, and so far worthy of being entitled *La Superba*, a closer examination of Genoa tends materially to lower its character for beauty and magnificence. Hemmed within walls, and built awkwardly on irregular rising grounds, it has never been opened up by any comprehensive plan of improvement, and remains very much a labyrinth of narrow and intricate lanes, accessible only

to foot-passengers, or to the pack-mules, by the use of which a large portion of the internal goods traffic is conducted. These thoroughfares, into which the light of day imperfectly penetrates, are lined with tall buildings, some of them of marble and of handsome architecture, but they can with difficulty be seen from the limitedness of the space in front; and however grand, they consequently fail in effect. Many of them—once the residence of merchant-princes—are now transformed into hotels or business establishments; in some cases, the superb lobbies, environed by marble columns, being occupied by petty traders, and shabby in the extreme. Only a few streets are wide enough for carriages, and in these the aspect of affairs is more like that of modern cities. Fallen from their high estate generally, several *palazzos* still belong to persons of distinction who have the means of maintaining them in their original splendor, or they are appropriated as public buildings. The two most famous are the Palazzo Ducale, formerly inhabited by the doges, now appropriated to the meetings of the senate; and the Palazzo Doria, presented, in 1522, to the great Genoese citizen Andria Doria, whose residence it was during his presidency of the republic. The palaces Brignole Sale, Serra, Reale, Pallavicini, Spinola Balbi, Negroni, and many others, possess great interest both on account of their historical fame and architectural beauty. Many of them contain galleries of paintings, which are shown for a fee. Some of the churches are particularly fine: the most noticeable of all being the cathedral of St. Lorenzo, a grand old pile in the Italian Gothic style. Genoa contains many excellent public institutions, which almost all date from the period of the republic. The great hospital, and the asylum for the poor (*Albergo de' Poveri*), are especially worthy of mention. The latter makes provision for 1600 persons, orphans and old people. The former are trained up to useful employments, and such girls as marry out of the hospital receive a small dowry. The deaf and dumb institution, and the hospital for the insane, are the first in Italy in point of extent and regulation. There are numerous excellent foundations called *conservatorie*, devoted to various philanthropic purposes, the chief of which is called the Fieschine, and is an asylum for female orphans. The public library contains 50,000 volumes, and is unrestrictedly open to the public. The academy of fine arts was founded by the Doria family. The theaters of Genoa are very fine; that of Carlo Felice ranks among the best in Italy.

The Genoese are a shrewd, active, laborious race, and possess all the qualities of a commercial and maritime community. They make skillful and hardy seamen, energetic traders, and thrifty husbandmen, and are still remarkable for the spirit of enterprise and freedom which so strongly characterized the period of the republic. Claiming Columbus as a native of their city, they have recently erected a handsome public monument in honor of that distinguished navigator. While the main business of the town is evidently maritime, there is also an extensive trade carried on in the manufacture and sale of a peculiar kind of jewelry. This consists of remarkably fine filigree-work in silver and silver gilt, which resembles that of India, and is fully as precious in point of intrinsic value. Few of the many tourists who pass through Genoa fail to purchase one or more of these pretty and cheap articles of bijouterie.

History.—The early history of Genoa, and of its ancient inhabitants is full of uncertainty, owing to the fabulous traditions by which it is obscured. The Ligurian tribes, who held possession of Genoa, previous to its incorporation with ancient Rome, are of disputed origin. By some historians, they are classed with the Celtic race, while others hold them to be of Greek extraction. Genoa is first mentioned in history during the second Punic war, but it then appears to have been a place of considerable importance. In 205 B.C., it became for a short time the head-quarters of Mago, the Carthaginian general, who destroyed it before leaving the country; but in 203 B.C., the Roman prætor, Sp. Lucretius, was commissioned to rebuild it. After Liguria was conquered by the Romans (109 B.C.), Genoa does not figure much in ancient history; but as a Roman *municipium*, it obviously prospered, for Strabo speaks of it as a "flourishing town, and the chief emporium of the Ligurians." Under the Romans, the Genoese retained a considerable decree of internal independence, and were distinguished in the Roman legions by their valor and great physical vigor. On the dismemberment of the Latin empire, Genoa, in common with the chief divisions of Italy, successively fell under the sway of the Lombards, the Franks, and the Germans; but amid all these vicissitudes, preserved, in a singular degree, both privileges and prosperity. Navigation and commerce were the two natural sources opened to the Genoese by the maritime situation of their country, and for these pursuits they have at all times displayed a special aptitude. Their mercantile interests only served to foster the instinctive valor of the race. The rich merchandise of the Genoese galleys offered an alluring prize to the piratical hordes by which the Mediterranean was universally infested; and, consequently, from the rise of their commercial importance, the Genoese were compelled to defend with the sword the precious freight of their merchantmen. Unhappily, a bitter spirit of hostility and intolerance of all maritime competition was a leading feature of early Genoese policy, in regard to the other important Italian states; and to this source may be traced the fierce and prolonged wars sustained by Genoa against the rival maritime republics of Pisa and Venice. The frequent incursions of the Saracens, by whom Genoa was sacked and pillaged about 935, led the Genoese to form an alliance with Pisa, with the object of extirpating these barbarous aggressors from the islands of Corsica and Sardinia, their

strongholds in the Mediterranean. This being effected (1016—1021), the Genoese obtained, by papal arbitration, the grant of Corsica, while Sardinia was assigned to the Pisans, a distribution which sowed the seeds of future discord between the two states. At the close of the 11th c., Genoa commanded large land and naval forces, and already ranked as a powerful maritime state, governed by annual magistrates, named consuls. The Genoese vigorously seconded the Crusades, and in return for their effective co-operation, obtained several important maritime possessions and commercial privileges in the Holy Land (1109). The chief events of the three following centuries are: the capture of Minorca (1146), of Almeria (1147), and Tortosa (1148), from the Moors; the wars with Pisa and Venice, and the civil dissensions by which Genoa, in common with all Italy, beeame distracted by the Guelph and Ghibelline factions. In 1284, at the great naval battle of Meloria, the Pisan republic sustained such destructive losses, that her maritime influence and public spirit never revived. The wars with Venice originated, about 1244, in mutual jealousies respecting the commercial supremacy of the Levant, and continued, with various vicissitudes, till the end of the following century, when the Genoese, at the blockade of Chiozza, were compelled to submit to disadvantageous terms by the peace of Turin (1381).

Co-existant with these suicidal wars, the civil dissensions of Genoa exhausted and and demoralized the state, and occasioned an infinity of changes in the primitive form of government. In 1190, the consuls were superseded by a magistracy termed *podesta*, an office for which natives of Genoa were declared ineligible. This institution, which was founded in the hope of restraining local Genoese animosities and ambitions, lasted till 1270, when two of the great Guelph leaders of the state resolved to subvert the popular authorities, and, under the title of "captains of liberty," assumed irresponsible authority, which, for 21 years, they contrived to retain. During their sway, civil feuds raged inveterately, not alone between the Guelph and Ghibelline factions, but also, between the citizen ranks of patricians and plebeians. Various other modifications of the government preceded the election of the first Genoese doge in 1339. This supreme magisterial office, from which all nobles were excluded, continued in force for two centuries, its tenure being for life.

The ambitious contentions of four leading democratical families—viz., the Adorni, the Fregosi, the Guarci, and the Montaldi—succeeded those of the patrician houses of Doria, Spinola, Grimaldi, and Fieschi, and engendered such disastrous civil strife in the state under the early doges, that, in 1396, the citizens, in despair, invoked the protection of the French king, Charles VI., and finally submitted to the rule of the visconte, the tyrranical and ambitious lords of Milan (1464). After the invasion of Louis XII. in 1499, Genoa long remained subject to the French; but in 1528, the genius and resolution of a great citizen, Andrea Doria, freed his country from foreign invaders, and restored to Genoa her republican institutions. The last important exploit of the Genoese was the expulsion, in 1746, of the Austrians, who were driven from Genoa after an occupation of three months. In 1768, Genoa ceded to France the island of Corsica; and in 1796, Bonaparte invaded Italy, and conferred on Genoa the name of the *Ligurian Republic*, which, in 1802, was abolished, and *Genoa la Superba* became the chief town of a department of France. In 1815, by a decree of the congress of Vienna, the state of Genoa became a province of Piedmont. Following the fortunes of that state, it has latterly become a portion of the kingdom of Italy, and with the enterprise of its people there are marked indications of improvement. Canale's *Nuova Storià della Republica di Genova;* Dinena's *Rivoluzioni d'Italia;* Sismondi's *Italian Republics.*

GEN'OA, Gulf of, a large indentation in the northern shore of the Mediterranean, n. of Corsica, may be said to have the shape of a bay rather than that of a gulf. The towns of Oneglia on the w., and Spezia on the e., seem to indicate the points at which the entrance of the gulf commences. With this entrance the gulf of Genoa would extend 90 m. across, and 30 m. inland.

GEN'OA, Thommasso Alberto Vittore, duke of, b. 1854; nephew of Victor Emmanuel and son of the duchess of Genoa. He was educated at Rugby, and in 1870 he came forward as a candidate for the Spanish throne, but at Victor Emmanuel's request he was retired. The duke visited the United States in 1874.

GENOUILLÈRE, a term in fortification (q.v.) for that part of the parapet of a battery which lies under the embrasure. The name is derived from Fr. *genou*, knee, as representing the ordinary height of the genouillère above the platform on which the gun is worked.

GENOVESI, Antonio 1712—69; an Italian writer on philosophy and political economy. At an early age he was destined by his father for the church, and began the study of philosophy and theology. He distinguished himself highly by his acuteness and dilligence, and after some struggles, caused by his disinclination for an ecclesiastical life, he took orders at Salerno in 1736. He had not been long in this position when the archbishop of the town, recognizing his rare abilities, nominated him to the chair of rhetoric in the theological seminary. During this period of his life, Genovesi began the study of philosophy as it existed outside the limits of theology. He read with eagerness the works of the chief modern philosophers, and was particularly attracted by Locke. Apparently still dissatisfied with ecclesiastical life, Genovesi, resigning his post at

Salerno, proceeded to Rome, undertook the study of law, and qualified as an advocate. The details of legal practice, however, proved as distasteful as theology, and for some years he gave himself up entirely to the study of philosophy, attending most of the distinguished lecturers at the university of Naples. At this place, after having obtained the appointment of extraordinary professor of philosophy, he opened a seminary or private college for students. His reputation as a teacher was increased by the publication in 1743 of the first volume of his *Elements of Metaphysics*, and in 1745 of his *Logic*. Both works are imbued with the spirit and principles of the empirical school of philosophy, and the latter, an eminently practical treatise, had long a recognized position as one of the best logical text-books written from the point of view of Locke. On account of the accusations of infidelity and heresy naturally excited by his discussions of metaphysical principles, he had some difficulty in obtaining the professorship of moral philosophy; and failed in his effort to be appointed to the chair of theology. This, however, did not prevent him from following out his philosophical studies. He published a continuation of his *Elements of Metaphysics;* but with every new volume he experienced fresh opposition from the partizans of scholastic routine. Among these were Cardinal Spinelli, archbishop of Naples, and an abbe Magli, whom Genovesi covered with ridicule in his work entitled *Lettere ad un Amico Provinciale*. In spite of this, Genovesi obtained the approbation of Pope Benedict XIV., of several cardinals, and of most of the learned men of Italy. Among them was Intieri, a Florentine, who founded, at his own expense, in the university of Naples, the first Italian chair of political economy, under three conditions,—namely, that the lectures should be in Italian, that Genovesi should be the first professor, and that, after his death, no ecclesiastic should succeed him.

GENRE-PAINTING, a term derived from the French *genre* ("kind," "sort"), originally employed to distinguish any special branch of painting, as *genre-historique* (historic painting), *genre du paysage* (landscape-painting), etc. In a more definite sense it is used to describe any picture containing human figures not included in the so-called historical class, particularly pictures with figures much below the size of life—cattle, architectural pieces, flower-pieces, and representations of still life. Under the term genre-pictures are comprehended all pictures with figures representing individuals only as types of a species or class, in contradistinction to historical compositions, which bring before us certain individuals, or, as it were, *nomina propria*. The mode of conception and style of execution in genre painting may resemble the historical style; and, on the other hand, historical personages may be represented merely in situations of everyday life. The term *historic-genre* is employed in both cases. The French likewise distinguish the *genre-historique* from the lower genre, strictly so called; they also occasionally apply the term *peinture du style* to historical painting. Genre-pictures are usually of limited dimensions, while in historical pictures the figures are commonly the size of life, or even colossal. In either case, however, there are many exceptions to the general rule, and the proper designation depends rather on the style of subject than on the size. A species of genre-painting with a distinct style was practiced even in ancient times, but the birthplace of the present genre picture is the north, and more particularly the Netherlands. The Italians, especially Paul Veronese, had previously showed a leaning to the genre style in biblico-historical pictures, by making the principal figures and the action subordinate to the accessories and locality—as, for example, in his "Marriage at Cana;" and Van Eyck's school in the Netherlands had likewise introduced the same element into the delineation of incidents in sacred history. Lucas van Leyden and Albert Dürer then began to represent actual scenes from the everyday life of the people in paintings and engravings. Genre-painting was brought to its highest perfection in the Netherlands by a series of admirable painters, such as Terburg, Brower, Ostade, Rembrandt, the younger Teniers, Metzu, Gerard Dow, and others. Though the characteristic and humorous conception of many of the works of these masters gives them a peculiar value, it was found in other cases that a certain delicacy of imitation and skill in using the brush was capable of imparting a singular charm to the most ordinary scenes and figures. In the British school this style of art is generally understood to be limited to pictures with figures, and many works of the highest excellence have been produced in it, elevated in treatment by the introduction of an important element—viz., the dramatic.

GENS (allied to Lat. *genus*, Eng. *kin;* from the root *gen-*, to beget or produce). This Latin word, to which so many important political and social meanings came to be attached, signifies, properly, a race or lineage. From it our own words gentleman (q.v.), gentility, etc., have come to us through the French *gentilhomme*, the primary meaning of which was, one who belonged to a known and recognized stock. By the Romans it was sometimes used to designate a whole community, the members of which were not necessarily connected by any known ties of blood, though some such connection was probably always taken for granted. In this sense we hear of the *gens Latinorum*, *campanorum*, etc. But it had a far more definite meaning than this in the constitutional law of Rome. According to Scævola, the pontifex, those alone belonged to the same *gens*, or were "gentiles," who satisfied the four following conditions—viz., 1. Who bore the same name; 2. Who were born of freemen; 3. Who had no slave amongst their ancestors; and 4. Who had suffered no *capitis diminutio* (reduction from a superior to an inferior condition), of which there were three degrees, maxima, media, minima.

The first (maxima capitis diminutio) consisted in the reduction of a free man to the condition of a slave, and was undergone by those who refused or neglected to be registered at the census, who had been condemned to ignominious punishments, who refused to perform military service, or who had been taken prisoners by the enemy, though those of the last class, on recovering their liberty, could be reinstated in their rights of citizenship. The second degree (media capitis diminutio) consisted in the reduction of a citizen to the condition of an alien (*Latinus* or *peregrinus*), and involved, in the case of a *Latinus*, the loss of the right of legal marriage (*connubium*), but not of acquiring property (*commercium*); and in the case of the *peregrinus*, the loss of both. The third degree (minima capitis diminutio) consisted in the change of condition of a *paterfamilias* into that of a *filius familias*, either by adoption (*adrogatio*) or by legitimation. In the identity of name, some sort of approach to a common origin seems to be here implied. The gens thus consisted of many families, but all these families were supposed to be more or less nearly allied by blood—to be, as we should say, kindred. A Roman gens was thus something very nearly identical with a Celtic clan, the identity or similarity of name being always supposed to have arisen from relationship, and not from similarity of occupation, as in the case of the Smiths, Taylors, Lorimers, etc., of modern Europe. There was this peculiarity, however, about the gens which did not belong to the clan—viz., that it was possible for an individual born in it to cease to belong to it by *capitis diminutio*, or by adoption, or adrogation as it was called when the person adopted was *sui juris* (q.v.). If the adoption was by a family of the same gens, the gentile name, of course, remained unchanged. In the case of a person dying intestate, his gentiles, failing nearer relatives, were his heirs, and they undertook the duties of guardianship in the like circumstances. The gens was further bound together by certain sacred rites, which were imposed on the whole of its members, and for the celebration of which it probably possessed, in common property, a *sacellum* or sacred spot enclosed, and containing an altar and the statue of the god to whom it was dedicated. According to the traditional accounts of the old Roman constitution, the gentes were a subdivision of the curiæ, as the curiæ were subdivisions of the tribe. In this view of the matter, the original idea of the gens becomes simply that of the smallest political division, without any relation to kindred or other ties.—An excellent article on the gens by Mr. George Long, in which references to the principal German authorities on the subject are given, will be found in Smith's *Dictionary of Roman Antiquities*.

GENSAN, a port in n. Corea, in the province of Ham-ki-ang, which borders on Russian Amooria. Gensan is situated in the center of a fertile region, just above the 39th parallel of n. latitude, on Broughton's bay, with a good harbor, and possessing considerable trade. The large city of Tokingen lies a few m. to the s., and the port of Katsuma is one league distant. It was opened under the treaty of Feb. 27, 1876, to Japanese trade and residence.

GEN'SERIC, King of the Vandals, was an illegitimate son of Godigiselus, who led the Vandals into Spain. After the death of his brother Gonderic, Genseric became sole ruler. In the year 429, he invaded Africa on the invitation of count Boniface; the viceroy of Valentinian III., emperor of the west, who had been goaded on to rebellion through the machinations of his rival Aetius, the conqueror of Attila. Genseric's army at first amounted to 50,000 warriors, full of barbarian valor, and hungry for conquest and plunder. As they swept along through Mauritania, the Kabyle mountaineers and the Donatist heretics, maddened by persecution and fanaticism, swelled the terrible horde, and more than equalled their savage associates in acts of cruelty and bloodthirstiness. The friends of Boniface, astonished that the hero who alone had maintained the cause of the emperor and his mother Placidia during their exile and distress, should have been guilty of such a crime, attempted, with ultimate success, to bring about an interview between the count of Africa and an agent of the empress. Then, when too late, were the imaginary provocations he had received explained, and the fraud of Aetius detected, for the army he had hurriedly collected to oppose the Vandals, having been twice defeated by Genseric, he was compelled to retire to Italy, where he was soon afterwards slain by Aetius. All Africa w. of Carthage fell into the hands of Genseric, who shortly after seized that city itself, and made it (439 A.D.) the capital of his new dominions. Part of Sicily, Sardinia, and Corsica, was likewise taken possession of by him. In the year 451, he encouraged Attila to undertake his great but fatal expedition against Gaul. Tradition states that, at the request of Eudoxia, the widow of Valentinian, who was eager for revenge upon her husband's murderer, Maximus, Genseric, in the year 455, marched against Rome, which he took, and abandoned to his soldiers for 14 days. On leaving the city, he carried with him the empress and her two daughters, one of whom became the wife of his son Huneric. The empire twice endeavored to avenge the indignities it had suffered, but without success. First the western emperor, Majorian, fitted out a fleet against the Vandals in 457, which was destroyed by Genseric in the bay of Carthagena; second, the eastern emperor, Leo, sent an expedition under the command of Heraclius and others in 468, which was also destroyed off the city of Bona. Genseric died in 477, in the possession of all his conquests, leaving behind him the reputation of being the greatest of the Vandal kings. His appearance was not imposing; according to Jornandes, he was "of low stature, and

lame on account of a fall from his horse," but "deep in his designs, taciturn, averse to pleasure, capable of being transported into fury, greedy of conquest, and cunning in sowing the seeds of discord among nations, and exciting them against each other." Strange to say, a rude, even a savage religiosity burned in the heart of Genseric, and, it may be, grimly sanctified, in his own eyes, his wide-spread devastations. He seems to have regarded himself as a "scourge of God." Once, when leaving the harbor of Carthage on an expedition, the pilot asked him whither he was going. "Against all who have incurred the wrath of God." In creed, Genseric was a fierce Arian, and inflicted the severest persecutions upon the orthodox or Catholic party.

GEN'TIAN (*Gentiana*), a genus of plants of the natural order *Gentianaceæ*, with 5-cleft—sometimes 4-cleft—calyx, and 1-celled capsule. The species are numerous, natives of temperate parts of Europe, Asia, and America, many of them growing in high mountain pastures and meadows, which they adorn by their beautiful blue or yellow flowers.—The genus is said to derive its name from Gentius, king of Illyria, who was vanquished by the Romans about 160 B.C., and to whom is ascribed the introduction into use of the species still chiefly used in medicine. This species, COMMON GENTIAN, or YELLOW GENTIAN (*G. lutea*), is abundant in the meadows of the Alps and Pyrenees, at an elevation of 3,000 to 6,000 feet. It has a stem about 3 ft. high, ovate-oblong leaves, and numerous whorls of yellow flowers. The part employed in medicine is the root, which is cylindrical, ringed, and more or less branched; and which appears in commerce in a dried state, in pieces varying from a few inches to more than a foot in length, and from half an inch to 2 in. in thickness. It is collected by the peasants of the Alps. Although gentian root has been examined by various chemists, its constituents are not very clearly known; it contains, however (1), an oil in small quantity; (2), a pale yellow crystalline matter, termed gentisin or gentisic acid; (3), a bitter principle, gentianite, on which its medicinal properties mainly depend; (4), pectin or pectic acid, which probably causes the gelatinization that sometimes occurs in infusion of gentian; and (5), sugar, in consequence of which an infusion is capable of undergoing vinous fermentation, and of forming the "bitter snaps" or "engiangeist" which is much employed by the peasants on the Swiss Alps, to fortify the system against fogs and damps. (As "bitter snaps" contains a narcotic principle, due probably to the oil of gentian, strangers unaccustomed to its use should take it with caution.) Gentian is a highly valued medicine, a simple tonic bitter without astringency, and is much used in diseases of the digestive organs, and sometimes as an anthelmintic.

Gentian may be administered in the form of infusion, tincture, or extract. The *compound mixture of gentian* of the London pharmacopœia, consisting of six parts of compound infusion of gentian (Ph. L.), three parts of compound infusion of senna (popularly known as *black draught*), and one part of compound tincture of cardamoms, forms, in doses of from 1 to 2 ozs., a safe and moderately agreeable tonic and purgative medicine in cases of dyspepsia with constipation. An imitation of the *compound tincture of gentian*, known as Stoughton's elixir, is very much used in the West Indies before meals as a pleasant bitter, to give tone to the languid stomach. The *extract of gentian* is very commonly used as the vehicle for the exhibition of metallic substances (such as salts of iron, zinc, etc.) in the form of pill. *Powdered gentian* is one of the chief constituents of an empirical medicine known as *the Duke of Portland's gout powder*. The bitter principle on which its virtue depends exists also in other species of this genus, probably in all, and appears to be common to many plants of the same order. The roots of *G. purpurea*, *G. punctata*, and *G. pannonica*, are often mixed with the gentian of commerce. They are deemed inferior. Several species are natives of Britain, but none are at all common except *G. campestris* and *G. amarella*, plants of a few inches in height, with small flowers, both of which are in use as tonics, although only in domestic medicine.—*G. Catesbæi*, a North American species, is extensively used in its native country, as a substitute for common gentian, and *G. Kurroo* is employed in the same way in the Himalaya.—Several species of gentian are common ornaments of our gardens, particularly *G. acaulis*, a small species with large blue flowers, a native of the continent of Europe and of Siberia, often planted as an edging for flower-borders. Of North American species, *G. crinita* is particularly celebrated for the beauty of its flowers, which are large, blue, and fringed on the margin. It has a branched stem, and grows in wet ground. The brilliancy of the flowers of the small Alpine species has led to many attempts to cultivate them, which have generally proved unsuccessful, apparently from the difficulty of imitating the climate and seasons of their native heights.

GENTIANA'CEÆ, or GENTIANEÆ, a natural order of exogenous plants, consisting chiefly of herbaceous plants, but containing also a few small shrubs. The leaves are opposite, rarely alternate, destitute of stipules. The flowers are terminal or axillary, generally regular. The calyx is divided usually into 5, sometimes into 4, 6, 8, or 10 lobes; the corolla is hypogynous (q.v.), has the same number of divisions with the calyx, and a plaited or imbricated twisted æstivation. The stamens are inserted upon the corolla, alternate with its segments, and equal to them in number. The ovary is composed of two carpels, 1-celled or imperfectly 2-celled, many-seeded. The fruit is a capsule or berry.—The species are numerous, about 450 being known. They are

natives both of warm and cold climates, but rather of elevated regions in the torrid and temperate zones than of cold regions near the poles. Many have flowers of great beauty, both of color and form, the corolla being often most delicately fringed. Many are medicinal, as GENTIAN, CHIRATA, FRASERA, BUCKBEAN, and CENTAURY. See these headings.

GENTIANEL'LA, a name sometimes given to the small-flowered or autumnal gentian (*gentiana amarella*), the beautiful blue flowers of which adorn some of the dry pastures of Britain; but more commonly to the species of *cicendia*, another genus of the order *gentianaceæ*, of which one (*C. filiformis*, formerly *exacum filiforme*) is a native of Britain, growing in sandy peat-soils, chiefly in the s.w. of England—a small, slender, and graceful plant with yellow flowers. *C. hyssopifolium* is much employed as a stomachic in India.

GENTILES, originally any one, not a Jew, equivalent in a religious view to "heathen," as commonly applied. St. Paul calls the Greeks Gentiles. In Solomon's temple, there was "a court of the Gentiles" in the outer space set off by a wall which strangers might not pass. The Mormons of Utah call those Gentiles who are neither Mormons, Jews, nor Indians. The Indians they believe to be the descendants of the last tribes of Israel.

GENTILESCHI, ARTEMISIA and ORAZIO DE, painters. Orazio, 1565–1646, is generally named Orazio Lomi de Gentileschi. It would appear that De Gentileschi was his real surname, Lomi being the surname which his mother had borne during her first marriage. He was born at Pisa, and studied with his half brother Aurelio Lomi, whom in course of time he surpassed. He afterwards went to Rome, and was associated with the landscape painter Agostino Tasi, executing the figures for the landscape backgrounds for this artist in the palazzo Rospigliosi, and it is said in the great hall of the Quirinal palace, although by some authorities the figures in the last-named building are ascribed to Lanfranchi. His best works are "Saints Cecelia and Valerian," in the palazzo Borghese, Rome; "David after the Death of Goliath," in the palazzo Doria, Genoa; and some works in the royal palace, Turin, noticeable for vivid and uncommon coloring. At an advanced age, Gentileschi went to England, at the invitation of Charles I., and was employed in the palace at Greenwich. Vandyck included him in his portraits of a hundred illustrious men. His works are generally strong in shadow and positive in color. He died in England. Artemisia, 1590–1642, Orazio's daughter, studied first under Guido, acquired much renown for portrait-painting, and considerably excelled her father's fame. She was a beautiful and elegant woman; her likeness, limned by her own hand, is to be seen in Hampton Court. Her most celebrated composition is "Judith and Holofernes," in the Pitti palace; certainly a work of singular energy, and giving ample proof of executive faculty, but repulsive and unfeminine in its physical horror. She accompanied her father to England, but did not remain there long. The best picture which she produced for Charles I. was "David with the Head of Goliath." Artemisia refused an offer of marriage from Agostino Tasi, and bestowed her hand on Pier Antonio Schiattesi, continuing, however, to use her own surname. She settled in Naples, whither she returned after her English sojourn. She lived there in no little splendor, and died there. She had a daughter, and perhaps other children.

GENTILLY, a populous t. of France, in the metropolitan department of Seine, is situated near Paris, towards the s. of that city. The great bastioned wall of Paris passes through the town, separating it into two portions, called Great and Little Gentilly. Pop. '76, 10,378, who are employed in the manufacture of chemicals, in quarrying, and in washing.

GENTLEMAN. This word is an example of those compromises so frequent in English between the language introduced by the Normans, and that in possession of the country at the period of the conquest. The Norman word was, as the French word is now, *gentilhomme*. The first syllable was retained, whilst the second was abandoned in favor of its Saxon equivalent, *man*. Though commonly translated into Latin by *generosus*, which means a generous, liberal, manly person, in short, a gentleman, the word gentleman is derived from *gentilis*, and *homo*, or man; and *gentilis* in Latin did not signify gentle, generous, or anything equivalent, but *belonging to a gens*, or known family or clan. See GENS. A gentleman was thus originally a person whose kindred was known and acknowledged; which is the sense in which it is still employed when it is not intended to make any reference to the moral or social qualities of the particular individual. One who was *sine gente*, on the other hand, was one whom no *gens* acknowledged, and who might thus be said to be ignobly born.

The term gentleman is continually confounded with esquire (q.v.), even by such learned authorities as Sir Edward Coke. But they are not equivalent; and whilst some attempt can be made to define the latter, the former seems, in England, from a very early time, to have been a mere social epithet. "Ordinarily, the king," says Sir Thomas Smith, "doth only make knights and create barons, or higher degrees; as for *gentlemen*, they be made good cheap in this kingdom; for whosoever studieth the laws of the realm, who studieth in the universities, who professeth the liberal sciences, and (to be short) who can live idly, and without manual labour, and will bear the port, charge, and

countenance of a gentleman, he shall be called Master, for that is the title which men give to esquires and *other gentlemen*, and shall be taken for a gentleman."—*Commonwealth of England*, i. c. 20. But though such was the real state of matters, even in the beginning of the 17th c., the word was still held to have a stricter meaning, in which it was more nearly synonymous with the French *gentilhomme*, for in the same chapter the same writer remarks that "gentlemen be those whom their blood and race doth make noble and known." Even here, however, it scarcely seems that he considered any connection with a titled family to be necessary to confer the character, for he afterwards speaks of it as corresponding, not to nobility, in the English sense, but to *nobilitas*, in the Roman sense, and as resting on "old riches or powers remaining in one stock." There can be no doubt that, in still earlier times, patents of gentility were granted by the kings of England.. There is one still in existence by Richard II. to John de Kingston, and another by Henry VI. to Bernard Angevin, a Burdelois. But these patents determine very little, for they seem to have carried the rank and title of esquire; and there is no doubt that esquires, and all persons of higher rank, were held to be gentlemen, on the principle, that the greater includes the less. The difficulty is to say whether between an esquire, who certainly was entitled to the character, and a yeoman, who was not, there was an intermediate class who could claim it on any other grounds than courtesy and social usage. These patents corresponded to the modern patents of arms which are issued by the Herald's colleges in England and Ireland, and by the Lyon office in Scotland, and were probably given on the very same grounds—viz., the payment of fees. A patent of arms confers the rank of esquire and there probably is no other legal mode by which an untitled person can acquire it, unless he be the holder of a dignified office. In present, as in former times, it is common to distinguish between a gentleman by birth and a gentleman by profession and social recognition. By a gentleman born is usually understood either the son of a gentleman by birth, or the grandson of a gentleman by position; but the phrase is loosely applied to all persons who have not themselves "risen from the ranks."

GENTLEMAN-COMMONER. See UNIVERSITY, OXFORD, etc.

GENTLEMEN-AT-ARMS (formerly called the GENTLEMEN-PENSIONERS), the body-guard of the British sovereign, and, with the exception of the yeomen of the guard, the oldest corps in the British service. It was instituted in 1509 by Henry VIII., and now consists of 1 captain, who receives £1200 a year; 1 lieutenant, £500; 1 standard-bearer, £310; 1 clerk of the check, £120; and 40 gentlemen, each with £70 a year. The pay is issued from the privy purse. Until 1861, the commissions were purchasable, as in other regiments; but by a royal command of that year purchase has been abolished in the corps, and, henceforth, the commissions as gentlemen-at-arms are to be given only to military officers of service and distinction. The attendance of the gentlemen-at-arms is now rarely required, except on the occasions of drawing-rooms, levées, coronations, and similar important state ceremonies. The appointment, which is in the sole gift of the crown, on the recommendation of the commander-in-chief, can be held in conjunction with half-pay or retired full-pay, but not simultaneously with any appointment which might involve absence at the time of the officer's services being required by the sovereign.

GENTOO' (Portuguese, *Gentio*, "Gentile") was the term applied by old English writers to the natives of Hindustan; it is now entirely obsolete, the word Hindoo, or properly Hindu, having been substituted.

GENTRY, a co. in n.w. Missouri, on Grand river; 500 sq.m.; pop. '70, 11,607—56 colored. The surface is uneven and partially covered with forests; soil fertile, producing corn, wheat, oats, etc. Co. seat, Albany.

GENTZ, FREIDRICH VON, 1764–1832; aptly described by Varnhagen von Ense as a writer-statesman. He was more than a publicist or political writer. His position was peculiar, and his career without a parallel. It is believed that no other instance can be adduced of a man exercising the same amount of influence in the conduct of public affairs, without rank or fortune, without high office, without being a member of a popular or legislative assembly, without in fact any ostensible means or instrumentality besides his pen. Born in the middle class in an aristocratic country, he lived on a social equality with princes and ministers, the trusted partaker of their counsels, and the chosen exponent of their policy. His father held an employment in the Prussian civil service; his mother was an Ancillon distantly related to the statesman of that name. On his father's promotion to the mint directorship at Berlin and consequent removal to the capital, he was sent to a gymnasium there, and in due course completed his education at the university of Frankfort-on-the-Oder. He is said to have shown neither liking nor aptitude for intellectual pursuits till after his attendance on the lectures of Kant at Konigsberg, in his twentieth, or twenty-first year, when, suddenly lighted up as by inspiration, he set to work in right earnest, mastered the Greek and Latin languages, acquired as perfect a knowledge of French as could well be attained by one who was not a Frenchman, and a sufficient familiarity with English to enable him to translate from it with clearness and fluency. He also managed to gain an intimate acquaintance with English commerce and finance, which he afterward turned to good account. The

extent of his acquirements was rendered more remarkable by his confirmed habits of dissipation; for from the commencement to the conclusion of his career he was remarkable for the manner in which, in the midst of the gravest occupations, he indulged his fondness for female society, and a ruinous passion for play. In 1786, he was appointed private secretary to the royal general directory, and was soon afterwards promoted to the rank of war councilor. Like Mackintosh, he was fascinated by the French revolution at its dawn, and, like Mackintosh, was converted to a sounder estimate of its then pending results by Burke. He broke ground in literature in 1794, by a translation of the celebrated *Essay on the French Revolution*, followed in 1794 and 1795 by translations from Mallet du Pan and Mounier. In 1795, he founded and edited a monthly journal which soon came to an untimely end. In Nov., 1797, he published a pamphlet under the title of a *Sendscreiben* or *Missive* addressed to Frederick William III. of Prussia on his accession, pointing out the duties of the new sovereign and especially recommending the complete freedom of the press. In the course of the next three years he contributed to the *Historisches Journal* a series of articles "On the Origin and Character of the War against the French Revolution," with express reference to Great Britain. These led to his visiting England, where he formed intimate acquaintances with Mackintosh, lord Grenville, Pitt, and other eminent men, which proved lasting, flattering, and remunerative. He was to all intents and purposes a mercenary of the pen, but he was so openly and avowedly, and he was never so much as suspected by those who knew him best of writing contrary to his convictions at the time. This is why he never lost the esteem and confidence of his employers,—of prince Metternich, for example, who, when he was officially attached to the Austrian government, was kept regularly informed of the sources from which the greater part of his income was derived. Embarrassments of all sorts, ties, and temptations, from which he was irresistibly impelled to tear himself, led to his change of country; and an entry for May, 1802, runs: "On the 15th, I take leave of my wife, and at three in the morning of the 20th, I leave Berlin with Adam Muller, never to see it again." It does not appear that he ever saw his wife again either; and his intimacies with other women, mostly of the highest rank, are puzzling from their multiplicity. He professes himself unable to explain the precise history of his settlement in Vienna. All he remembers is that he was received with signs of jealousy and distrust, and that the emperor, to whom he was presented by count Collorado, showed no desire to secure his services. Many years were to elapse before the formation of the connection with Metternich, the most prominent feature and crowning point of his career. Before entering into any kind of engagement with the Austrian government, he applied to the king of Prussia for a formal discharge, which was granted with an assurance that his majesty, "in reference to his merits as a writer, coincided in the general approbation which he had so honorably acquired." A decisive proof of the confidence placed in him was his being invited by count Haugwitz to the Prussian head-quarters shortly before the battle of Jena, and commissioned to draw up the Prussian manifesto and the king's letter to Napoleon. It was in noticing this letter that Napoleon spoke of the known and avowed writer as "a wretched scribe named Gentz, one of those men without honor who sell themselves for money." In the course of 1806, he published *War between Spain and England*, and *Fragments upon the Balance of Power in Europe*, on receiving which (at Bombay) Mackintosh wrote: "I assent to all you say, sympathize with all you feel, and admire equally your reason and your eloquence throughout your masterly fragment." The bond of union between him and Metternich was formed in 1810. This was one reason, joined to his general reputation, for his being named first secretary to the congress of Vienna in 1814, where, besides his regular duties, he seems to have made himself useful to several of the plenipotentiaries, as he notes in his diary that he received 22,000 florins in the name of Louis XVIII. from Talleyrand, and £600 from lord Castlereagh, accompanied by "*les plus folles promesses*." He acted in the same capacity at the congress or conference of Paris in 1815, of Aix in 1818, Karlsbad and Vienna in 1819, Troppau and Laybach in 1820 and 1821, and Verona in 1822. The following entry in his diary for Dec. 14, 1819, has exposed him to much obloquy as the interested advocate of reactionary doctrines: "About eleven, at prince Metternich's, attended the last and most important sitting of the commission to settle the 13th article of the Bundes-Akt, and had my share in one of the greatest and worthiest results of the transactions of our time. A day more important than that of Leipsic." The 13th article provides that in all the states in the Bund the constitutional government shall be by estates instead of by a representative body in a single chamber; "*in allen Bundestaaten wird eine landstandische Verfassung stattfinden.*" Remembering what issued in France from the absorption of the other estates in the Tiers Etat, it would have been strange if Gentz had not supported this 18th article. He was far from a consistent politician, but he was always a sound conservative at heart; and his reputation rests on his foreign policy, especially on the courage, eloquence, and efficiency with which he made head against the Napoleonic system until it was struck down. The most remarkable phase of Gentz's declining years was his passion, in his sixty-seventh year, for Fanny Elssler, the celebrated danseuse, which forms the subject of some very remarkable letters to his attached friend Rahel (wife of Varnhagen von Ense) in 1830 and 1831. He died June 9, 1832. There is no complete edition of his works. The late baron von

Prokesch was engaged in preparing one when the Austrian government interfered, and the design was perforce abandoned. [*Encyc. Brit.*, 9th ed.]

GENUFLEXION, the act of kneeling or bending the knees in worship. As an act of adoration, or reverence, there are frequent allusions to genuflexion in the Old and in the New Testaments: as Gen. xvii. 3 and 17; Numbers xvi. 22; Luke xxii. 41; Acts vii. 60, and ix. 40; Philip. ii. 10. That the use continued among the early Christians is plain from the *Shepherd* of Hermas, from Eusebius's *History*, ii. 33, and from numberless other authorities; and especially from the solemn proclamation made by the deacon to the people in all the liturgies—"*Flectamus genua*" (Let us bend our knees); whereupon the people knelt, till, at the close of the prayer, they received a corresponding summons—"*Levate*" (Arise). It is worthy of remark, however, that in celebration of the up-rising (resurrection) of our Lord, the practice of kneeling down at prayer, so early as the age of Tertullian, was discontinued throughout the Easter-time, and on all Sundays through the year. The kneeling posture was especially assigned as the attitude of penance, and one of the classes of public penitents in the early church took their name, *genuflectentes*, from this circumstance. In the modern Roman Catholic church, the act of genuflexion belongs to the highest form of worship, and is frequently employed during the mass, and in the presence of the consecrated elements when reserved for subsequent communion. In the Anglican church, the rubric prescribes the kneeling posture in many parts of the service; and this, as well as the practice of bowing the head at the name of Jesus, was the subject of much controversy with the Puritans. The same controversy was recently revived in Germany.

GE'NUS (Lat. a kind), in natural history, a group of species (q.v.), closely connected by common characters or natural affinity. See GENERALIZATION. In all branches of zoology and botany, the name of the genus forms the first part of the scientific name of each species, and is followed by a second word—either an adjective or substantive—which distinguishes the particular species. Thus, in *solanum tuberosum* (the potato), *solanum* is the *generic*, and *tuberosum* the *specific* (sometimes styled the *trivial*) name. This method was introduced by Linnæus, and has been of great advantage to the progress of science, simplifying the nomenclature, and making names serve, in some measure, for the indication of affinities. The affinities indicated by the generic name are often recognized even in popular nomenclature—thus, elm and *ulmus* are perfectly synonymous; but there are many instances in which this is very far from being the case, as that of the genus *solanum*. The arrangement of species in groups called genera has no real relation to any of the important questions concerning species.—Genera are arranged in larger groups, called *orders*, which are often variously subdivided into *sub-orders*, *families*, *tribes*, etc.; and are themselves grouped together in *classes*, which are referred to *divisions* of one or other of the *kingdoms* of nature. Some genera contain hundreds of species; others no more than one; and although future discoveries may add to the number in many of the smallest genera, yet it cannot be doubted that a very great difference exists in the number actually belonging to groups equally distinct and natural. Some of the larger genera are, by some authors, divided into sub-genera; and too many naturalists show an extreme anxiety to multiply generic divisions and names, perhaps forgetting that whilst certain affinities may be thus indicated, the indication of others is necessarily lost, whilst the memory of every student of science is more and more heavily burdened. There can be no doubt, however, that to a certain extent the fluctuations of nomenclature, so often felt to be annoying, mark the progress of science and the removal of errors.

In mineralogy, the generic name is not adopted as the primary part of the name of each species. *Gem* (q.v.) is an example of a mineralogical genus.

GENZA'NO, or GENSANO, a t. of the province of Rome, Italy, 17 m. s.-by-e. from Rome, in a district of hills and ravines. Genzano has several broad and straight streets, proceeding from a handsome square, which is ornamented with a beautiful fountain. On one of the hills above the town is the feudal mansion of the Cessarini family. Genzano is celebrated for an annual festival, held on the eighth day after *Corpus Christi*, called the *Infiorata di Genzano*, from the custom of strewing the streets with flowers, so as to represent arabesques, heraldic devices, figures, etc. On occasion of the festival, many visitors are attracted from Rome. Pop. 5,000.

GEOCEN'TRIC means, having the earth for center; thus the moon's motions are geocentric; also, though no other of the heavenly bodies revolves round the earth, yet their motions are spoken of as geocentric when referred to, or considered as they appear from, the earth.

The geocentric latitude of a planet is the inclination to the plane of the ecliptic of a line connecting it and the earth; the geocentric longitude being the distance measured on the ecliptic from the first point of Aries of the point in the ecliptic to which the planet as seen from the earth is referred.

GE'ODES (Gr. *earthy*) are rounded hollow concretions, or indurated nodules, either empty or containing a more or less solid and free nucleus, and having the cavity frequently lined with crystals. They are sometimes called "potato stones," on account

of their size and shape. The name *geode* seems to have been given them because they are occasionally found filled with a soft earthy ocher.

GEOD'ESY, the science of the measurement of the earth's surface, and of great portions of it. The reader will find under EARTH the principal results of geodetical measurements, and under TRIANGULATION, an account of some of the methods of obtaining them. Geodesy has many physical difficulties to contend against. In measuring a particular length with a view to obtaining a base line for calculating other lines by trigonometrical observations, there is first a difficulty arising in the use of the unit of length, whatever it may be, whether rod or chain. In the use of rods, it is difficult to lay them all precisely in the same direction, and to prevent error arising from intervals between the rods. In the use of chains, again, the greatest care is needed to keep all the links stretched, while the difficulty of avoiding error through not preserving the line of direction is but little diminished. Further, in all cases, the tendency of the units to change magnitude with changes of temperature, and the unevenness of the earth's surface, are pregnant sources of error. After all these difficulties have been overcome, and a sufficient base line obtained, a new class of difficulties are encountered. In taking trigonometrical observations of distant objects, it is found that the three angles of any triangle which we may form are together in excess of two right angles; the angles are, in fact, more of the nature of spherical than plane angles. For this, in using the angles as plane angles (for greater simplicity), a correction has to be made. Further, a correction is required for the effect of horizontal refraction on the results of observations on distant objects—a most fluctuating source of error—to evade which, as far as possible, it is usual to make observations when the atmosphere has been for some time undisturbed. See Puissant's work on Geodesy.

GEOFFREY OF MONMOUTH, called also **JEFFREY AP ARTHUR**, was b. at Monmouth, and in 1152 was consecrated bishop of St. Asaph. He died about 1154. His chief work, the *Chronicon sive Historia Britonum*, seems to have been completed about 1128. It is a tissue of the wildest fables, interwoven with some historic traditions. "In later times," says Dr. Lappenberg, "authors seem to have unanimously agreed in an unqualified rejection of the entire work, and have therefore failed to observe that many of his accounts are supported by narratives to be found in writers wholly unconnected with, and independent of Geoffrey. He professes to have merely translated his work from a chronicle in the British tongue, called *Brut y Brenhined*, or History of the Kings of Britain, found in Brittany, and communicated to him by Walter, archdeacon of Oxford [not, as has been supposed, Walter Mapes, but an earlier Walter Calenius]. The *Brut* of Tysilio has, with some probability, been regarded as the original of Geoffrey's work, though it is doubtful whether it may not itself be rather an extract from Geoffrey. That the whole is not a translation appears from passages interpolated, in many places verbatim, from the existing work of Gildas, of whom he cites another work, *De Vita Ambrosii*, no longer extant." Geoffrey's work was first printed by Ascensius at Paris in 1508, and has been reprinted more than once. An English translation, by Aaron Thompson, appeared at London in 1718, reprinted by Dr. Giles in 1842, and in Bohn's antiquarian library, 1848. Whatever its value as a historical record, the chronicle has been of great use to our literature. Versified in the Norman dialect by Wace, and again in English by Layamon, we are indebted to it for the story of Lord Sackville's tragedy of *Ferrex and Porrex*, for Shakespeare's *King Lear*, for some of the finest episodes in Drayton's *Polyolbion*, and for the exquisite fiction of Sabrina in Milton's masque of *Comus*. A metrical *Life and Prophecies of Merlin*, first printed at Frankfurt in 1603, and reprinted for the Roxburghe club in 1830, has been attributed to Geoffrey of Monmouth, but without sufficient grounds.

GEOFFRIN, MARIE THÉRÈSE, a distinguished Frenchwoman, b. at Paris, June 2d, 1699. She was the daughter of a valet-de-chambre, named Rodet, a native of Dauphiné; and in her fifteenth year was married to a very rich manufacturer in the Faubourg St. Antoine, who died not long after, leaving her an immense fortune. Madame Geoffrin, though but imperfectly educated herself, had a genuine love of learning, and her house soon became a rendezvous of the philosophers and *littérateurs* of Paris. No illustrious foreigner visited the city without obtaining an introduction to her circle; even crowned heads were among her visitors. Her liberality to men of letters, and especially the delicacy with which she conferred her benefits, reflect the highest credit on her character. Among those who frequented her house was Poniatowski, afterwards king of Poland. He announced to her his elevation to the throne in these words: "*Maman, votre fils est roi*." In 1766, he prevailed on her to visit Warsaw, where she was received with the greatest distinction. Subsequently, in Vienna, the empress Maria Theresa and her son, Joseph II., honored her with a most gracious reception. She died in Oct., 1777, leaving legacies to most of her friends. Towards the publication of the *Encyclopédie* she contributed, according to the calculations of her daughter, more than 100,000 francs. D'Alembert, Thomas, and Morellet, wrote éloges upon her, which are to be found in the *Éloges de Madame Geoffrin* (Paris, 1812). Morellet likewise published her treatise *Sur la Conversation*, and her *Lettres*.

GEOFFROY SAINT-HILAIRE, ETIENNE, a French zoologist and physiologist, was b. at Etampes in 1772, and d. at Paris in 1844. He was destined by his family for the

clerical profession, and sent to prosecute his studies at the college of Navarre, where he attended the lectures of Brisson, who speedily awakened in him a taste for the natural sciences. He subsequently became a pupil of Haüy (q.v.) and of Daubenton; and the relations which were soon established between his masters and himself were attended with the happiest results to science, since they decided the future prospects of Geoffroy, and saved the life of Haüy, who had been imprisoned as a refractory priest, and whom Geoffroy rescued from prison on the very eve of the massacres of Sept. 1792. A few months afterwards, Haüy obtained for him the post of sub-keeper and assistant-demonstrator at the Jardin des Plantes; and in June, 1793, on the reorganization of the institution, he was nominated professor of the zoology of vertebrated animals. At first, he refused to accept the chair, on the ground that all his studies had been directed to mineralogy; but he finally yielded to the urgent persuasion of his old master Daubenton, and at once set resolutely to work. At this time, he was only 21 years of age.

Immediately after his installation, he commenced the foundation of the menagerie at the Jardin des Plantes, its beginning being three itinerant collections of animals that had been confiscated by the police, and were conveyed to the museum. All the departments of the museum over which he had charge soon exhibited signs of his vigorous administration; and the zoological collection became the richest in the world.

In 1795, Geoffroy having heard from the Abbé Tessier that he had found a young man in the wilds of Normandy who was devoting all his leisure time to natural history, and having subsequently received from the stranger a communication containing some account of his investigations, wrote thus to his unknown correspondent: "Come to Paris without delay; come and assume the place of a new Linnæus, and become another founder of natural history." It was thus that Georges Cuvier was called to Paris by the prophetic summons of Geoffroy. An intimate friendship was soon established between them, which, although long afterwards broken by the asperity of scientific discussion, was finally revived with all its original warmth in their later days.

In 1798, Geoffroy formed one of the scientific commission that accompanied Bonaparte to Egypt, and he remained in that country until the surrender of Alexandria in 1801. He succeeded in bringing to France valuable collections of natural history specimens; and memoirs in which he described them led to his election, in 1807, into the academy of sciences. In 1808, he was charged with a scientific mission to Portugal, the object of which was to obtain from the collections in that kingdom all the specimens which were wanting in those of France. On his return, he was appointed to the professorship of zoology in the faculty of science at Paris, and from that time he undertook no more expeditions, but devoted himself almost exclusively to science. In the latter years of his life, he was stricken with total blindness, but the physical repose to which he was consequently condemned, seemed to increase his intellectual activity; and to the very last days of his life, he was occupied with those abstruse questions of biology which had influenced his whole scientific career. Throughout almost all his writings, we find him endeavoring to establish one great proposition—namely, the unity of the organic plan of the animal kingdom. This was the point on which he and Cuvier mainly differed, and on which there were very warm discussions between these two eminent naturalists in the academy of sciences in 1830. In adition to numerous memoirs in various scientific periodicals, he published various works, amongst which we may mention his *Philosophie Anatomique* (2 vols. 1818–20), which contains the exposition of his theory; *Principes de la Philosophie Zoologique* (1830), which gives a synopsis of his discussions with Cuvier; *Etudes Progressives d'un Naturalists* (1835); *Notions de Philosophie Naturelle* (1838); and (in conjunction with Frédéric Cuvier), *Histoire Naturelle des Mammifères* (3 vols. folio, 1820–1842). His son has published an excellent history of his life and labors, under the title, *Vie, Travaux, et Doctrine Scientifique d'E. Geoffroy Saint-Hilaire* (1848), to which, as well as to *L'Eloge Historique de Geoffroy Saint-Hilaire* by Flourens, we are indebted for many of the details contained in this sketch. We may also refer to a very able sketch of the life and doctrines of this great naturalist, in the appendix to De Quatrefages's *Rambles of a Naturalist*, vol. i. pp. 312–324.

GEOFFROY SAINT-HILAIRE, Isidore, a French physiologist and naturalist, son of Etienne Geoffroy, was b. in Paris in 1805, and died in that city in 1861. Educated in natural history by his father, he became assistant naturalist at the museum when only 19 years of age, and in 1830 he delivered the zoological lectures in that institution as his father's substitute. The science of teratology (q.v.), or of the laws which regulate the development of monstrosities, which had occupied much of his father's attention, was taken up with great zeal by the son, and in 1832 he published the first volume of his *Histoire Générale et Particulière des Anomalies de l'Organisation chez l'Homme et les Animaux, ou Traité de Tératologie*, the third and concluding volume of which did not appear till 1837. This work is of extreme value, and will always serve as the starting-point for those who may occupy themselves with this important branch of biological investigation. Having for a long time the superintendence of the menagerie of the museum, he was led to study the domestication of foreign animals in France; and the results of these investigations may be found in his *Domestication et Naturalisation des Animaux Utiles* (1854), and especially in the *Société pour l'Acclimatation des Animaux Utiles*, of which he was the founder. In 1852, he published the first volume of a great

work entitled, *Histoire Générale des Règnes Organiques*, in which he intended to develop the doctrines handed down to him by his father, but, which is left in an unfinished state by his premature death. He was a strong advocate of the use of horse-flesh as human food, and published his *Lettres sur les Substances Alimentaires, et particulièrement sur la Viande de Cheval* (1856), with the view of bringing his views on the subject before the general public.

GEOG'NOSY (*gē*, the earth; *gnōsis*, knowledge) is a term now little used by British writers, but still employed in Germany as a synonym of geology, or, more properly, as restricted to the observed facts of geology, apart from reasonings or theories built upon them. The geognost examines the nature and position of the rocks of a country, without grouping them together in the order of succession. Of necessity, geognosy preceded geology; it was indeed geology in its early empirical condition, when it consisted merely of a record of observed facts; but as soon as these assumed a scientific form, and were arranged into a system, then geognosy disappeared; for even in the examination of new and unexplored territories, the data supplied by the science of geology enable us to refer the strata with certainty to their true chronological position.

The word has also been employed to designate that department of geology which treats of the physical characteristics of rocks; that is, of their chemical composition, internal structure, planes of division, position and other properties, and peculiarities belonging to them simply as rocks.

GEOGRAPHICAL DISTRIBUTION OF ANIMALS. Each great geographical or climatal region of the globe is occupied by some species of animals not found elsewhere. Thus, the ornithorhynchus belongs exclusively to Australia; the sloth, to America; the hippopotamus and camelopard, to Africa; and the reindeer and walrus to the arctic regions; and each of these animals, when left in its natural freedom, dwells within certain limits, to which it always tends to return, if removed by accident or design. A group of animals inhabiting any particular region, and embracing all its species, both aquatic and terrestrial, is called its FAUNA (q.v.), just as the collective plants of a country are termed its FLORA. There is a close and obvious connection between the fauna of any place and its temperature, although countries with similar climates are not always inhabited by similar animals; and the soil and vegetation are likewise important factors in determining the characters of any special fauna.

The influence of climate is well seen in the distribution of animals in the arctic regions. The same animals inhabit the northern polar regions of Europe, Asia, and America. Thus, for example, the polar bear, whales, seals, and numerous birds, are common to the northern regions of these three continents. In the temperate regions, on the other hand, the types remain the same, but they are represented by different species, which still, however, retain the same general features. These general resemblances often led our early American colonists erroneously to apply the names of European species to the similar, but not identical animals of the New World. Similar differences occur in distant regions of the same continent, within the same parallel of latitude. Thus, as prof. Agassiz has remarked, the animals of Oregon and of California are not the same as those of New England; and the difference, in some respects, is even greater than between the animals of New England and Europe; and similarly, the animals of temperate Asia differ more from those of Europe, with which they are continuous, than they do from those of America, from which they are separated by a large surface of ocean.

Under the torrid zone, we not only find animals different from those occurring in temperate regions, but we likewise meet with a fauna which presents the greatest variety amongst the individuals which constitute it. "The most gracefully proportioned forms," says Agassiz, "are found by the side of the most grotesque, decked with every combination of brilliant coloring. At the same time, the contrast between the animals of different continents, is more marked; and in many respects, the animals of the different tropical faunas differ not less from each other than from those of the temperate or frozen zones; thus, the fauna of Brazil varies as much from that of Central Africa as from that of the Southern United States. This diversity in different continents cannot depend simply upon any influence of the climate of the tropics; if it were so, uniformity ought to be restored in proportion as we recede from the tropics towards the antarctic temperate region. But instead of this, the differences continue to increase—so much so, that no faunas are more in contrast than those of cape Horn, the cape of Good Hope, and New Holland. Hence, other influences must be in operation besides those of climate, etc.—influences of a higher order, which are involved in a general plan, and intimately associated with the development of life on the surface of the earth." If space permitted, we might point out the influence of the natural features of the earth's surface in limiting and separating faunas. A mountain chain or a desert may act as effectually as the depths of ocean in separating one fauna from another. When no such obstacles exist, one fauna gradually merges into another, without any definite line of demarkation.

The powers of locomotion possessed by different animals have not—as we might have supposed—any apparent influence on the extent of country over which they range. On the contrary, animals whose locomotive powers are extremely small, as, for example,

the common oyster, have a far greater range than some of our fleet animals, such as the moose.

"The nature of their food has an important bearing upon the grouping of animals, and upon the extent of their distribution. Carnivorous animals are generally less confined in their range than herbivorous ones, because their food is almost everywhere to be found. The herbivora, on the other hand, are restricted to the more limited regions corresponding to the different zones of vegetation." Similarly, birds of prey, like the eagle and vulture, have a much wider range than the granivorous and gallinaceous birds; but even the birds that wander furthest, have their definite limits; for example, the condor of the Cordilleras, although, from the extreme heights at which he is often seen, he cannot fear a low temperature, is never found in the temperate region of the United States.

A very influential factor is the distribution of aquatic animals in the depths of water. The late prof. Forbes distinctly showed that we may recognize distinct faunas in zones of different depth, just as we mark different zones of animal and vegetable life in ascending lofty mountains. The zoophytes, molluscs, and even fishes, found near the shore in shallow water, usually differ very materially from those living at the depth of 20 or 30 ft.; and these, again, are different from those which are met with at a greater depth. The extreme depth at which animal life, in its lower forms, ceases to exist, is unknown; late researches, particularly the observations made in H.M.'s ships *Porcupine* and *Challenger*, show that the region of animal life extends *bathymetrically* (to use prof. Forbes's word) much further than was formerly supposed, though beyond the depth of 6,000 ft. it gradually diminishes.

Before concluding these general remarks, we must observe that occasionally one or more animals are found in one very limited spot, and nowhere else; as, for example, the chamois and the ibex upon the Alps. (On this point, the reader should consult Darwin's *Journal of Researches*, etc., in which it is shown that the Galapagos Archipelago, consisting of a small group of islands situated under the equator, and between 500 and 600 m. westward of the coast of America, not only contain numerous animals and plants that are found in no other part of the world, but that many of the species are exclusively confined to a single island.)

All the faunas of the globe may be divided into three great groups, corresponding to the three great climatal divisions—viz., the arctic or glacial, the temperate, and the tropical faunas while the two last-named faunas may be again divided into several zoological provinces. Each of these primary divisions demands a separate notice.

ARCTIC FAUNA.—The limits of this fauna are easily fixed, as we include within them all animals living beyond the line where forests cease, and are succeeded by vast arid plains known as barren lands, or *tundras*. Though the air-breathing species are not numerous here, the large number of individuals compensates for this deficiency, and among the marine animals we find an astonishing profusion and variety of forms. The larger mammals which inhabit this zone are the white bear, the walrus, numerous species of seal, the reindeer, the musk-ox, the narwal, the cachalot, and whales in abundance. Among the smaller species, we may mention the white fox, the polar hare, and the lemming. Some marine eagles and a few wading-birds are found; but the aquatic birds of the family of Palmipedes (the web-footed birds), such as the gannets, cormorants, penguins, petrels, ducks, geese, mergansers, and gulls, abound in almost incredible profusion. No reptile is known in this zone. Fishes are very numerous, and the rivers, especially, swarm with a variety of species of the salmon family. The articulata are represented by numerous marine worms, and by minute crustaceans of the orders *isopoda* and *amphipoda;* insects are rare, and of inferior types (only six species of insects were observed in Melville island during Parry's residence of eleven months there). Only the lowest forms of mollusca are found, viz., *tunicata* and *acephala*, with a few *gasteropoda*, and still fewer *cephalopoda*. The *radiata* are represented by numerous jelly-fishes (especially the beröe), by several star-fishes and echini, and by very few polypes.

With this fauna is associated a peculiar race of men, known in America under the name of Esquimaux (q.v.), and in the Old World under the names of Laps, Samoyedes, and Tchuktsches. "This race," says Agassiz, "differs alike from the Indians of North America, from the whites of Europe, and the Mongols of Asia, to whom they are adjacent. The uniformity of their characters along the whole range of the arctic seas, forms one of the most striking resemblances which these people exhibit to the fauna with which they are so closely connected.

TEMPERATE FAUNAS.—To the glacial zone, which encloses a single fauna, succeeds the temperate zone, included between the isothermes (or lines of equal mean temperature) of 32° and 74°, characterized by its pine-forests, its maples, its walnuts, and its fruit-trees, and inhabited by the terrestrial bear, the wolf, the fox, the weasel, the marten, the otter, the lynx, the horse and ass, the bear, numerous genera and species of deer, goats, sheep, oxen, hares, squirrels, rats, etc.; and southwards by a few representatives of the tropical zone. Considering the whole range of the temperate zone from east to west, Agassiz divides it, in accordance with the prevailing physical features, into —1st, the *Asiatic* realm, embracing Mantchuria, Japan, China, Mongolia, and passing through Turkestan into, 2d, the *European* realm, which includes Iran, Asia Minor, Mesopotamia, Northern Arabia and Barbary, as well as Europe properly so called; the

western parts of Asia and the northern parts of Africa being intimately connected by their geological structure with the southern part of Europe; and 3d, the *North American* realm, which extends as far s. as the table-land of Mexico.

The temperate zone is not characterized, like the arctic, by one and the same same fauna. Not only are the animals different in the eastern and western hemispheres, but there are differences in the various regions of the same hemisphere: as we before remarked, the species resemble, but are not identical with one another. Thus, in Europe, we have the brown bear; in North America, the black bear; and in Asia, the bear of Tibet; the common stag or red deer of Europe is represented in North America by the Canadian stag or wapiti and the American deer, and in eastern Asia by the musk-deer; the North American buffalo is represented in Europe by the wild aurochs of Lithuania, and in Mongolia by the yak; and numerous other examples might readily be given.

The marked chang s of temperature between the different seasons occasion migrations of animals more in this zone than any other, and this point must not be overlooked by the naturalist in determining the fauna of a locality within it. Many of the birds of northern Europe and America, in their instinctive search for a warmer winter climate, proceed as far southward as the shores of the Mediterranean and of the gulf of Mexico. See MIGRATIONS OF ANIMALS.

Amongst the most characteristic of the animals of the *Asiatic* realm, we may mention the bear of Tibet, the musk-deer, the tzeiran (*Antilope gutturosa*), the Mongolian goat, the argali, the yak, the Bactrian or double-hunched camel, the wild horse, the wild ass, and other equine species, the dtschigetai (*equus hemionus*). The nations of men inhabiting these realms all belong to the so-called Mongolian race.

That the *European* is a distinct zoological realm, seems to be established, says Agassiz, "by the range of its mammalia, and by the limits of the migrations of its birds, as well as by the physical features of its whole extent. Thus we find its deer or stag, its bear, its hare, its squirrel, its wolf and wild cat, its fox and jackal, its otter, its weasel and marten, its badger, its bear, its mole, its hedgehogs, its bats, etc. Like the eastern realm, the European world may be subdivided into a number of distinct faunas, characterized each by a variety of peculiar animals. In western Asia, we find, for instance, the common camel instead of the Bactrian; whilst Mount Sinai, Mounts Taurus and Caucasus have goats and wild sheep which differ as much from those of Asia as from those of Greece, the Alps, the Atlas, or of Egypt." There is no reason for our referring, as many writers have done, our chief domesticated animals to an Asiatic origin. A wild horse, different in species from the Asiatic breeds, once inhabited Spain and Germany, and a wild bull existed over the whole range of central Europe. The domesticated cat, whether we trace it to *felis maniculata* of Egypt or to *felis catus* (the wild cat) of central Europe, belongs to this realm; and whatever theory be adopted regarding the origin of the dog, the European realm forms its natural range. The merino sheep is still represented in the wild state by the moufion of Sardinia, and formerly ranged over all the mountains in Spain. The hog is descended from the common boar, still found wild over most of the temperate zone of the old world. Ducks, geese, and pigeons have their wild representatives in Europe. The common fowl and the turkey are, on the other hand, not indigenous, the former being of e. Asiatic, and the latter of American origin. The reader will observe that the European zoological realm is circumscribed within exactly the same limits as the so called white race of man.

The *American* realm contains many animals not found in Europe or Asia, amongst which we may mention the opossum; several species of insectivora, as, for example, the shrew-mole (*scalops aquaticus*) and the star-nosed mole (*condylura cristata*), several species of rodents (especially the musk rat), the Canadian elk, etc., in the northern portion; and the prairie-wolf, the fox-squirrel, etc., in the southern portion of the fauna. Amongst other types characteristic of this zone must be reckoned the snapping-turtle among the tortoises; the *menobranchus* and *menopoma* among the salamanders; and the rattlesnake among the serpents; and the *lepidosteus* and the *amia*, important representatives of two almost extinct families, among the fishes.

The faunas of the southern temperate region differ from one another more than those of the corresponding northern region. "Each of the three continental peninsulas jutting out southerly into the ocean, represents, in some sense, a separate world. The animals of South America beyond the tropic of Capricorn are in all respects different from those at the southern extremity of Africa. The hyenas, wild boars, and rhinoceroses of the cape of Good Hope have no analogies on the American continent; and the difference is equally great between the birds, reptiles, fishes, insects, and molluscs. New Holland, with its marsupial mammals, with which are associated insects and molluscs no less singular, furnishes a fauna still more peculiar, and which has no similarity to those of any of the adjacent countries. In the seas of that continent, we find the curious shark, with paved teeth and spines on the back (*cestracion Phillippii*), the only living representative of a family so numerous in former zoological ages."

TROPICAL FAUNAS are distinguished in all the continents by the immense variety of animals which they contain, and in many cases by the brilliancy of their color. Not only are all the principal types of animals represented, but genera, species, and individuals occur in abundant profusion. The tropical is the region of the apes and monkeys (which seem to be naturally associated with the distribution of the palms, which

furnish to a great extent the food of the monkeys on both continents), of herbivorous bats, of the great pachyderms, such as the elephant, the hippopotamus, and the tapir, and of the whole family of edentata. Here, too, are the largest of the cats, the lion and the tiger. Among birds, the parrots and toucans are essentially tropical: amongst the reptiles, the largest serpents, crocodiles, and tortoises belong to this zone, as also do the most gorgeous insects. The marine fauna is also superior in beauty, size, and number to those of other regions. The tropical fauna of each continent furnishes new and peculiar forms. Sometimes whole types are restricted to one continent, as the sloths, the toucans, and the humming-birds to America; the gibbons, the red orang, the royal tiger, and numerous peculiar birds to Asia; and the giraffe and hippopotamus to Africa; while sometimes animals of the same group present different characteristics on different continents. Thus, for example, the American monkeys have flat and widely separated nostrils, 36 teeth, and generally a long prehensile tail; while the monkeys of the old world have their nostrils close together, only 32 teeth, and non-prehensile tails.

The island of Madagascar has its peculiar fauna. A large number of species of quadrumana, cheiroptera, insectivora, etc., are found only in this island; and of 112 species of birds that have been described, 65, or more than half, are found nowhere else. We have already referred to the still more exclusive fauna of the Galapagos islands, which has been specially studied by Darwin.

The multiplicity of facts in zoological distribution, which cannot be accounted for by climate, or any other external existing cause, has given rise to various explanations. Until recently, the received theory was that the several species of animals had been originally created in certain spots named *specific centers*, whence they migrated more or less widely, and that they had existed unchanged throughout the longest succession of generations. This theory was felt from the first to be unscientific; and increasing knowledge of the facts rendered it less and less satisfactory. Other schemes of distribution, into which the consideration of the *Distribution of Life in Past Ages* and the *Doctrine of Evolution* largely enter, are accordingly now in favor. Mr. Sclater, followed by Mr. Wallace, divides the earth into six main zoological regions. In one of these, the Palæarctic, consisting of the northern portion of the old world, it is held that animal life originated—at least in its higher forms. Each of the other regions, it is argued, has been at one time or another in connection with this original seat of life, and has received its supply of animals from it by migration. Geological revolutions have gradually produced the present state of the earth's surface, and the new conditions of life met by the migrated animals have, in accordance with the theory of evolution, so modified them as to produce the varying fauna of the globe. In those countries which have been longest and most completely separated from each other the difference of animal life will be found greatest.

See the various works of Agassiz; Vogt's *Zoologische Briefe*, vol. ii.; Mrs. Somerville's *Physical Geography*, vol. ii.; Maury's *La Terre et l'Homme;* Klöden's *Handbuch der Physischen Geographie;* Schmarda's great work, *Die Geographische Verbreitung der Thiere;* and especially *The Geographical Distribution of Animals*, by A. R. Wallace (1876).

GEOGRAPHICAL DISTRIBUTION OF PLANTS, also called GEOGRAPHICAL BOTANY, and PHYTOGEOGRAPHY, is that branch of botany which treats of the geographic distribution of plants, and connects botany with physical geography. A knowledge of facts belonging to it has been gradually accumulating ever since the science of botany began to be studied, but its importance was little understood until very recent times. Humboldt may be said to have elevated it to the rank which it now holds as a distinct branch of science. It was indeed impossible for botany to be studied without attention being arrested by the great diversity of the productions of different countries, and even of those not very dissimilar in climate. But it was long ere important generalizations were attempted; and a large accumulation of particular facts was in the first place necessary. Even to this day, the deficiency of information concerning the botany of wide regions is painfully felt.

Every climate has plants particularly adapted to it. The plants of the tropics will not grow in frigid, nor generally even in temperate regions; as little will arctic or subarctic plants endure the heat of the torrid zone. And as the climate changes with the elevation above the level of the sea, the mountains of tropical countries have a flora analogous to that of the temperate, and even of the frigid zones. The vegetation of every place bears a relation to its mean annual temperature. But owing to the peculiarities of different plants, it bears also important relations to the mean temperatures of the summer and winter months; and thus great diversities are found not only in the indigenous vegetation of countries very similar in their mean annual temperature, but even in their suitableness for plants which may be introduced into them by man. Nor is temperature the only thing of importance in relations of climate to vegetation. Moisture must be ranked next to it. Some plants flourish only in a dry, and some only in a humid atmosphere. The flora of the very dry regions of Africa and of Australia is almost as notably different from that of moist countries in similar latitudes as that of the temperature from that of the torrid zone. Nor is the difference merely in the species of plants produced, but in the whole character of the vegetation, which very much consists either of succulent plants with thick epidermis, or of plants with hard and dry foliage.

Much depends also on soil. Sandy soils have their peculiar vegetation: peat is also favorable to the growth of many plants which are seldom or never to be found in any other soil. The chemical constitution of soils determines to some extent the character of their flora; and therefore certain plants are almost exclusively to be found in districts where certain rocks prevail, and a relation is established between botany and geology. Limestone districts, for example, have a flora differing to a certain extent from other districts even of the same vicinity. Some British plants are almost entirely limited to the chalk districts. The other physical qualities of the soil are not unimportant. Light soils are suitable to plants with fine roots divided into many delicate fibrils, as heaths, which will scarcely grow in stiff clay.

Some groups of plants are almost entirely limited to peculiar situations, as the *algæ* and other smaller groups of *aquatic* plants. Some are exclusively tropical; others are only found in the colder parts of the world; and if any of the group occur within the tropics, it is on mountains of considerable elevation. But besides all this, and apart from all obvious differences of climate, soil, etc., some groups of plants, and these often containing many species, are only or chiefly found in certain parts of the world. Thus the *cactaceæ* are exclusively American; whilst of the numerous species of heath (*erica*), not one is indigenous to America, although many other plants of the heath family (*ericeæ*) are so. Sometimes the plants which chiefly abound in one part of the world seem to be replaced by other but similar species, sometimes by those of another group, in another part of the world, with similar physical characteristics. Thus *mesembryaceæ* and *crassulaceæ* seem in some countries to occupy the place of the American *cactaceæ*, whilst the black-fruited crow-berry (*empetrum*) of the northern parts of the world finds a representative in a red-fruited species, extremely similar, in the southern parts of South America. Of many groups which chiefly belong to certain climates or certain parts of the world, there are yet species which wander, as it were, into very different climates or remote parts of the world; these species being often, however, unknown where the other species of the group abound. Thus the common periwinkle is a northern wanderer of a family mostly tropical. Some groups are common to parts of the world widely remote, and their prevalence is characteristic of these parts, as *rhododendrons* and *magnoliaceæ* of North America and of the mountainous districts of the East Indies, although the American and the Asiatic species are not the same. Some species are believed to exist only within a very narrow range; others are very widely diffused. A few are found in the colder parts both of the northern and southern hemispheres, and also on the intervening tropical mountains. Some groups also, containing many species, are confined to particular regions, as the important *cinchonæ* to a district of the Andes, and the *calceolariæ* to higher parts of the same mountain chain.—Marine vegetation, like terrestrial vegetation, has species and groups that are very generally diffused, and others confined to particular regions.

The geographical limits of species have no doubt been in many instances unintentionally modified by man, and the extent of this modification it is extremely difficult to ascertain. There is enough, however, in the known facts of botanical geography, evidently independent of such agency, to afford foundation for interesting and important speculations, of which some notice will be taken under the head SPECIES.

Many of the principal facts of botanical geography will be found stated in the articles EUROPE, ASIA, AMERICA, and AUSTRALIA, and in articles on natural orders and genera of plants. Schouw and Meyen are among the chief authorities on this subject; and the former has endeavored to divide the earth into 25 botanical regions, characterized by the prevalence of particular forms of vegetation. The reader will find much information on botanical geography, collected in a very accessible form, in the *Physical Atlas* of Johnston and Berghaus.—Henfrey's *Vegetation of Europe* (Van Voorst, London, 1852) may be consulted with advantage; and the *Cybele Britannica*, and *Geography of British Plants*, of Mr. H. C. Watson, treating of the geographic distribution of plants in the British isles, are unrivaled among works of their kind.

GEOGRAPHY (Gr. *gē*, the earth, *graph-*, to write or describe) is, as its name implies, a description of the earth. This science is best considered under the three distinct heads of *Mathematical* or *Astronomical* geography, *Physical* geography, and *Political* geography, which all admit of further subdivision into numerous subsidiary branches.

Mathematical or *Astronomical* geography describes the earth in its planetary relations as a member of the solar system, influencing and influenced by other cosmical bodies. It treats of the figure, magnitude, and density of the earth; its motion, and the laws by which that motion is governed; together with the phenomena of the movements of other cosmical bodies, on which depend the alternation of day and night, and of the seasons of the year, and the eclipses and occultations of the sun, moon, and planets; it determines position and estimates distances on the earth's surface, and teaches methods for the solution of astronomical problems, and the construction of the instruments necessary for such operations, together with the modes of representing the surface of the earth by means of globes, charts, and maps. The numerous subjects comprised in this portion of geographical science will be found in other parts of the present work, and we therefore refer our readers for further particulars to the several articles in which they are more fully treated, as, for instance, ASTRONOMY, LATITUDE AND LONGITUDE, MATHEMATICAL INSTRUMENTS, OBSERVATORIES, etc.

Physical geography, as the name indicates, considers the earth in its relation to nature and natural or physical laws only. It describes the earth, air, and water, and the organized beings, whether animal or vegetable, by which those elements are occupied, and considers the history, extent, mode, and causes of the distribution of these beings. This may be regarded as the most important branch of geographical science, since it involves the consideration and study of phenomena, which not only tend to further the material interests of man, by teaching him how best to promote the development of the products of nature, but also conduce in no inconsiderable degree to general intellectual advance, by stimulating the faculties of observation, and exercising the powers of thought. The vast sphere of inquiry included in physical geography necessarily embraces the consideration of all the natural sciences generally, and we can here, therefore, merely refer our readers for more special information regarding the details of the subject to such articles as CLIMATE, HEAT, LAKES, RIVERS, MOUNTAINS, OCEAN, WINDS, RAIN, CLOUDS; ETHNOLOGY, GEOGRAPHICAL DISTRIBUTION OF ANIMALS AND PLANTS, etc.

Political geography has been well defined as "including all those facts which are the immediate consequences of the operations of man, exercised either on the raw materials of the earth, or on the means of his intercourse with his fellow-creatures." Thus considered, it embraces, primarily, the description of the political or arbitrary divisions and limits of empires, kingdoms, and states; and, secondarily, that of the laws, modes of government, and social organization which prevail in the several countries. The details of this branch of geography will be found under the names of countries, cities, etc., while more general information in regard to the subject must be sought from historical, political, and statistical sources.

Before proceeding to sketch the progress and history of geographical discovery, we will indicate a few of the leading works that afford the best aid in studying the three main branches of geography to which we have referred. Thus, for instance, in mathematical geography, we would specially instance: *Manual of Geographical Science* (Part I. *Mathematical Geography*, by Mr. O'Brien); Herschel's *Outlines of Astronomy;* Klöden's *Erdkunde* (Part I.): in physical geography, Ritter's *Erdkunde;* Klöden's; A. Maury's *La Terre et l'Homme;* Mrs. Somerville's *Physical Geography;* Mr. F. Maury's *Physical Geography of the Sea*, etc.: while in regard to political geography, information may be sought from the great works of Ritter, Berghaus, Stein, Wappäus, and Klöden, and from the ordinary geographical manual and maps.

Geographical Discovery.—The earliest idea formed of the earth by nations in a primeval condition seems to have been that it was a flat circular disk, surrounded on all sides by water, and covered by the heavens as with a canopy, in the center of which their own land was supposed to be situated. The Phœnicians were the first people who communicated to other nations a knowledge of distant lands; and although little is known as to the exact period and extent of their various discoveries, they had, before the age of Homer, navigated all parts of the Euxine, and penetrated beyond the limits of the Mediterranean into the Western ocean, and they thus form the first link of the great chain of discovery which, 2,500 years after their foundation of the cities of Tartessus and Utica, was carried by Columbus to the remote shores of America. Besides various settlements nearer home, these bold adventurers had founded colonies in Asia Minor about 1200 B.C., and a century later they laid the foundation of Gades, Utica, and several other cities, which was followed, in the course of the 9th c. by that of Carthage, from whence new streams of colonization continued for several centuries to flow to hitherto unknown parts of the world. The Phœnicians, although less highly gifted than the Egyptians, rank next to them in regard to the influence which they exerted on the progress of human thought and civilization, for their knowledge of mechanics, their early use of weights and measures, and what was of still greater importance, their employment of an alphabetical form of writing, facilitated and confirmed commercial intercourse among their own numerous colonies, and formed a bond of union which speedily embraced all the civilized nations of Semitic and Hellenic origin. So rapid was the advance of geographical knowledge between the age of the Homeric poems (which may be regarded as representing the ideas entertained at the commencement of the 9th c. B.C.) and the time of Hesiod (800 B.C.), that while in the former the earth is supposed to resemble a circular shield, surrounded by a rim of water, spoken of as the parent of all other streams, and the names of Asia and Europe applied only, the former to the upper valley of the Caÿster, and the latter to Greece n. of Peloponnesus, Hesiod mentions parts of Italy, Sicily, Gaul, and Spain, and is acquainted with the Scythians, and with the Ethiopians of Southern Africa. During the 7th c. B.C., certain Phœnicians, under the patronage of Neku or Necho II. king of Egypt, undertook a voyage of discovery, and are supposed to have circumnavigated Africa. This expedition is recorded by Herodotus, who relates that it entered the Southern ocean by way of the Red sea, and after 3 years' absence, returned to Egypt by the Pillars of Hercules. The fact of an actual circumnavigation of the African continent has been doubted, but the most convincing proof of its reality is afforded by the observation which seemed incredible to Herodotus, viz., "that the mariners who sailed round Libya (from e. to w.) had the sun on their right hand." The 7th and 6th centuries B.C. were memorable for the great advance made in

regard to the knowledge of the form and extent of the earth. Thales, and his pupil Anaximander, reputed to have been the first to draw maps, exploded many errors, and paved the way, by their observations, for the attainment of a sounder knowledge. The logographers contributed at this period to the same end by the descriptions which they gave of various parts of the earth; of these, perhaps the most interesting to us is the narrative of the Carthaginian Himilco, who discovered the British islands, including the Œstrymnides, which he described as being a four months' voyage from Tartessus.

With Herodotus of Halicarnassus (born 485 B.C.), who may be regarded as the father of geography as well as of history, a new era began in regard to geographical knowledge, for although his chief object was to record the struggles of the Greeks and Persians, he has so minutely described the countries which he visited in his extensive travels (which covered an area of more thrn 31° or 1700 m. from e. to w., and 24° or 1660 m. from n. to s.). that his history gives us a complete representation of all that was known of the earth's surface in his age. This knowledge, which was extremely scanty, consisted in believing that the world was bounded to the s. by the Red sea or Indian ocean, and to the w. by the Atlantic, while its eastern boundaries, although admitted to be undefined, were conjectured to be nearly identical with the limits of the Persian empire, and its northern termination somewhere in the region of the amberlands of the Baltic, which had been visited by Phœnician mariners, and with which the people of Massilia (the modern Marseilles) kept up constant intercourse by way of Gaul and Germany. In the next century, the achievements of Alexander the Great tended materially to enlarge the bounds of human knowledge, for while he carried his arms to the banks of the Indus and Oxus, and extended his conquests to northern and eastern Asia, he at the same time promoted science, by sending expeditions to explore and survey the various provinces which he subdued, and to make collections of all that was curious in regard to the organic and inorganic products of the newly visited districts; and hence the victories of the Macedonian conqueror formed a new era in physical inquiry generally, as well as in geographical discovery specially. While Alexander was opening the east to the knowledge of western nations, Pytheas, an adventurous navigator of Massilia, conducted an expedition past Spain and Gaul through the channel, round the e. of England into the Northern ocean, where, after six days' sailing, he reached Thule (conjectured to be Iceland). and returning, passed into the Baltic, where he heard of the Teutones and Goths. Discovery was thus being extended both in the n. and e. into regions whose very existence had never been suspected, or which had hitherto been regarded as mere chaotic wastes. An important advance in geography was made by Eratosthenes (born 276 B.C.), who first used parallels of longitude and latitude, and constructed maps on mathematical principles. Although his work on geography is lost, we learn from Strabo that he considered the world to be a sphere revolving with its surrounding atmosphere on one and the same axis, and having one center. He believed that only about one-eighth of the earth's surface was inhabited, while the extreme points of his habitable world were Thule in the n., China in the e., the Cinnamon coast of Africa in the s., and the Prom. Sacrum (cape St. Vincent) in the west. During the interval between the ages of Eratosthenes and Strabo (born 66 B.C.), many voluminous words on geography were compiled, which have been either wholly lost to us, or only very partially preserved in the records of later writers. Strabo's great work on geography, which is said to have been composed when he was 80 years of age, has been considered as a model of what such works should be in regard to the methods of treating the subject; but while his descriptions of all the places he has himself visited are interesting and instructive, he seems unduly to have discarded the authority of preceding writers.

The wars and conquests of the Romans had a most important bearing upon geography, since the practical genius of the Roman people led them to the study of the material resources of every province and state brought under their sway, and the greatest service was done to geographical knowledge by the survey of the empire, which was begun by Julius Cæsar, and completed by Augustus. This work comprised a description and measurement of every province by the most celebrated geometricians of the day. Pliny (born 23 A.D.), who had traveled in Spain, Gaul, Germany, and Africa, has left us a compendium of the geographical and physical science of his age in the four books of his *Historia Naturalis* which he devotes to the subject. He collected with indefatigable industry the information contained in the works of Sallust, Cæsar, Tacitus, and others, to which he added the results of his own observations, without, however, discriminating between fact and fiction. The progress that had been made since Cæsar's time in geographical knowledge is evinced by Pliny's notice of arctic regions and of the Scandinavian lands, and the accounts which he gives of Mt. Atlas, the course of the Niger, and of various settlements in different parts of Africa, while his knowledge of Asia is more correct than that of his predecessors, for he correctly affirms that Ceylon is an island, and not the commencement of a new continent, as has been generally supposed. The study of geography in ancient times may be said to have terminated with C. Ptolemy, who flourished in the middle of the 2d c. of our new era. His work on geography, in eight books, which continued to be regarded as the most perfect system of the science through the dark middle ages down to the 16th

c., gives a tolerably correct account of the well known countries of the world, and of the Mediterranean, Euxine, and Caspian, together with the rivers which fall into those seas, but it added little to the knowledge of the n. of Europe, or the extreme boundaries of Asia or Africa. Yet, from his time till the 14th c., when the records of the travels of the Venetian Marco Polo opened new fields of inquiry, the statements of Ptolemy were never questioned, and even during the 15th c., it was only among a few German scholars at Nürnberg that the strange accounts given of distant eastern lands by the Venetian traveler were received as trustworthy where he differed from Ptolemy. Marco Polo had, however, unfortunately made no astronomical observations, nor had he even recorded the length of the day at any place, and hence the Nürnberg geographers, who had no certain data for estimating the extent of the countries which he had traversed, were the means of propagating errors which led to results that were destined to influence the history of mankind; for, taking Ptolemy's tables as their basis, they had incorporated on their globes and maps the results of their own rough estimates of the length of Marco Polo's days' journeys, and they had thus represented the continent of Asia as extending across the Pacific, and having its eastern shores somewhere in the region of the Antilles. These erroneous calculations misled Christopher Columbus to the false assumption that, by sailing 120° w., he would reach the wealthy trading marts of China, and the result of this conviction was his entering upon that memorable expedition which terminated in the discovery (in 1492) of the continent of America. Although there can be no doubt that the American continent was visited in the 9th and 10th c. by Northmen, the event remained without influence on the history of discovery, and cannot therefore detract from the claims of Columbus. This momentous discovery, which had been preceded in 1486 by the exploration of the African coast as far as the cape of Good Hope (which was doubled by Vasco da Gama in 1497), was followed by a rapid succession of discoveries; and within 30 years of the date of the first voyage of Columbus, the whole coast of America from Greenland to cape Horn had been explored, the Pacific ocean had been navigated, and the world circumnavigated by Magellan (q.v.) the coasts of eastern Africa, Arabia, Persia, and India had been visited by the Portuguese, and numerous islands in the Indian ocean discovered. The 16th c. was marked by continued attempts, successful and unsuccessful, to extend the sphere of oceanic discovery; and the desire to reach India by a shorter route than those by the cape of Good Hope or cape Horn, led to many attempts to discover a n.w. passage, which, though they signally failed in their object, had the effect of very materially enlarging our knowledge of the arctic regions. The expeditions of Willoughby and Frobisher in 1553 and 1576, of Davis (1585), Hudson (1607), and Baffin (1616), were the most important in their results towards this end. The 17th and 18th centuries gave a new turn to the study of geography, by bringing other sciences to bear upon it, which, in their turn, derived elucidation from the extension of geographical knowledge; and it is to the aid derived from history, astronomy, and the physical and natural sciences, that we owe the completeness which has characterized modern works on geography. In the 17th c., the Dutch, under Tasman and Van Diemen, made the Australasian islands known to the civilized world; and in the latter half of the 18th c., capt. Cook extended the great oceanic explorations by the discovery of New Zealand and many of the Polynesian groups; but he failed to find the antarctic continent, which was first visited in 1840 by American, English, and French expeditions, under their respective commanders, Wilkes, Ross, and Dumont d'Urville. Polar exploration, after having been for a time in abeyance, has within late years been vigorously prosecuted by the United States and various European countries. In America, the travels of Humboldt, Lewis and Clark, Fremont, and others, have done much to make us acquainted with broad general features, but much remains to be done in regard to special districts of Central and Southern America. In Asia, numerous travelers, geographers, and naturalists have contributed to render our knowledge precise and certain in respect to a great part of the continent, whose natural characteristics have been more especially represented by the great physicist Ritter: while we owe a large debt of gratitude to the Jesuit missionaries, whose indefatigable zeal has furnished us with a rich mass of information in regard to minor details of Asiatic life and nature. In Africa, the combined influences of a deleterious climate, and a religion hostile to European advance, have hitherto retarded explorations into the interior; but notwithstanding these obstacles, much light has been thrown on the character and condition of the African continent by many of its greatest explorers—as Bruce, Park, Clapperton, Adamson, the Landers, Burton, Speke, Barth, Vogel, Livingstone, Cameron, and Stanley. In Australia, although much still remains to be done, the obscurity which had hitherto hung over the interior has been to a great extent diminished by the explorations of Sturt, Eyre, Leichhardt, and the brothers Gregory; and still more by the highly important labors of Burke and Wills, who in 1860 crossed the Australian continent from Melbourne to Carpentaria. Although both these intrepid explorers perished miserably from starvation on their return route, their journals and the description that has been given by them and their sole-surviving companion, King, of the country through which they passed, prove that the land is far from being the desert it was once imagined to be.

The progress which has marked recent discovery has been materially aided by the

encouragement and systematic organization which have been given to plans of exploration by the public governments of different countries, and by the efforts of the numerous geographical societies which have been formed during the present century both at home and abroad; while the constantly increasing mass of information collected by scientific explorers is rapidly diffusing correct information in regard to distant regions, and thus effectually dispelling the numerous fallacies which have hitherto obscured the science of geography. Among the numerous works of authority on the subject of geographical discovery, the following may be consulted with advantage: Hudson's *Geographi Græci minores; Précis de Geographie Universelle*, by Malte Brun; *Manual of Geographical Science* (mathematical, physical, historical, and descriptive), 1860; Latham's *Germania* of Tacitus; Humboldt's *Hist. crit. de l'Hist. de la Géographie, Asie, Centrale*, and the *Cosmos;* Ritter's *Asien;* Kloeden's *Erdkunde.* The recent progress of geographical discovery may be traced in Petermann's *Mittheilungen*, the *Geographical Magazine*, and the *Proceedings of the Geographical Society.*

GEOGRAPHY, MEDICAL. The liability of particular localities to become the centers of special diseases, or groups of diseases, has been observed from the most ancient periods, as we have excellent evidence in the hippocratic treatise. *On airs, waters, and places*, one of the undoubtedly genuine works of the great Greek physician, and one of those which best sustains his traditional reputation. Now-a-days, medical geography has become a most elaborate and carefully investigated branch of medical science, the details of which, though of considerable popular interest, are far too complicated and too technical to be discussed with advantage here. The reader may be referred to the articles ENDEMIC DISEASE, CLIMATE, AGUE, DYSENTERY, GOITER, LEPROSY, YELLOW FEVER, PLAGUE, REMITTENT FEVER, for incidental illustrations of the subject. Generally speaking, the tropics are subject to diarrhœal diseases, with acute affections of the liver, and severe remittent or pestilential fevers, caused by the exalted temperature acting on the soil, and producing emanations very destructive of health; the like causes in more temperate climates causing ague and diarrhœa, especially during the summer and autumn in low-lying, ill-drained localities. Temperate climates are also subject in a peculiar degree to pulmonary diseases, and to all manner of contagious fevers, the result of overcrowding and confined air. Certain diseases, again, as goiter, leprosy, and some animal parasites (see ENTOZOA), appear to have no relation to climate, but are found to affect, more or less exclusively, certain well-defined districts of country; as in the case of the Guinea-worm, the Egyptian ophthalmia, the pellagra of Lombardy, the beri-beri of Ceylon and the Malabar coast, and the elephantiasis of the Indian peninsula generally. The best works on medical geography are those of Mühry, in Germany, and Boudet, in France, which are remarkably learned and complete treatises on the whole subject. A more recent one still is that of Dr. August Hirsch of Danzig, a work of immense labour and erudition, not yet completed. On tropical diseases generally, the English works of Annesley, Twining, Morehead, and sir Ranald Martin are of confirmed reputation.

GEOLOGY (Gr. *ge* and *logos*), the science of the earth, should include all the sciences that treat of the constitution and distribution of the inorganic matter of the earth, as well as those which describe the living beings that inhabit it; just as astronomy includes the whole science of the heavenly bodies. In this wide sense, as comprising all the physical sciences, it has sometimes been used. As usually employed, however, it has a much more limited meaning, being confined to that section of the sciences which takes cognizance of the hard crust of the earth—of the materials of which it is composed, and of the manner in which these materials are arranged.

The structure of the earth received little attention from the ancients: the extent of its surface known was limited, and the changes upon it were neither so speedy nor violent as to excite special attention. The only opinions deserving to be noticed, that have come down to us, are those of Pythagoras and Strabo. They both observed the phenomena which were then altering the surface of the earth, and proposed theories for explaining the changes that had taken place in geological time. The first held that, in addition to volcanic action, the change in the level of sea and land was owing to the retiring of the sea; while the other maintained that the land changed its level, and not the sea, and that such changes happened more easily to the land below the sea because of its humidity.

From the fall of the Roman empire, during the dark ages, the cultivation of the physical sciences was neglected. In the 10th c., Avicenna, Omar, and other Arabian writers, commented on the works of the Romans, but added little of their own.

Geological phenomena attracted attention in Italy in the 16th c., the absorbing question then being as to the nature of fossils. On the one side, it was held that they were the results of the fermentation of fatty matter, or of terrestrial exhalations, or of the influence of the heavenly bodies, or that they were mere earthy concretions or sports of nature; while only a few maintained that they were the remains of animals. Two centuries elapsed before this opinion was generally adopted. At the outset, it was unfortunately linked to the belief that the fossils were relics of the Noachian deluge.

Steno (1669) observed a succession in the strata, and asserted that there were rocks older than the fossiliferous strata in which no organic remains occur; he also distin-

guished between marine and fluviatile formations. He was not able, however, to free himself from the absurd hypotheses of his day.

In England, the diluvialists were busy framing idle theories, to give a plausibility to their creed that the Noachian deluge was the cause of all the past-changes on the earth's surface. Differing somewhat in detail, they all agreed in the notion of an interior abyss, whence the waters rushed, breaking up and bursting through the crust of the earth, to cover its surface, and whither, after the deluge, they returned again. Such absurd dreams, obviously opposed to the observed order of nature, greatly hindered the progress of true science.

Leibnitz (1680) proposed the bold theory that the earth was originally in a molten state from heat, and that the primary rocks were formed by the cooling of the surface, which also produced the primeval ocean, by condensing the surrounding vapors. The sedimentary strata resulted from the subsiding of the waters that had been put in motion from the collapse of the crust on the contracting nucleus. This process was several times repeated, until at last an equilibrium was established.

Hooke (1688) and Ray (1690,) differing as much from Burnet as from Leibnitz, advocated views similar to those of Pythagoras. They considered the essential condition of the globe to be one of change, and that the forces now in action would, if allowed sufficient time, produce changes as great as those of geological date. They were followed in the same direction by Vallisneri (1720), Moro (1740), Buffon (1749), Lehman (1756), and Fuchsel (1773), each contributing something additional. Werner (1780) greatly advanced the science by establishing the superposition of certain groups, by giving a system and names, and by showing the practical applications of geology to mining, agriculture, and medicine. He had very crude notions regarding the origin of the strata, supposing that the various formations were precipitated over the earth in succession from a chaotic fluid; even the igneous rocks he held to be chemical precipitates from the waters. Hutton (1788), rejecting all theories as to the beginning of the world, returned to the opinions of Pythagoras and Ray. He held that the strata which now compose the continents were once beneath the sea, and were formed out of the waste of pre-existing continents by the action of the same forces which are now destroying even the hardest rocks. He introduced the notion of a periodical elevation of the sedimentary deposits from the internal heat raising the bed of the sea. Lyell, in our own day, adopted and improved these views, eliminating the baseless theories which were mixed up with them, and demonstrating that existing forces might produce all the phenomena of geology.

The determination of the order of the strata, and the grouping of them in chronological order, were begun by Lehman (1756), and carried on by Fuchsel (1773), Pallas (1785), and Werner. Smith made the most important contribution to this subject when, in 1790, he published his *Tabular View of the British strata.* He showed their superposition, and characterized the different groups by their peculiar fossils. The publication of his geological map of England (1815) may be said to form an epoch in the history of geology. Since then, the science has advanced by rapid strides; and it is not too much to expect that ere long all the chief geological features of the accessible parts of the world will be known and published.

Geology, in its restricted and usual sense, takes cognizance of the solid substance of of the earth, or rather of as much of it as is accessible to man's observation. He has not, by his own efforts, penetrated at any point more than a few hundred yards from the surface; but natural sections, and the peculiar arrangement of the stratified rocks (the key to which he has to some extent obtained), have given him an aquaintance with a greater thickness than could have resulted from his own labors. He has thus by actual observations, coupled with reasonings upon them, been able to construct an ideal section representing a depth of perhaps 10 m., or about a 400th part of the distance from the surface to the centre. He does not, and cannot with certainty, know anything of the structure or condition of what is deeper. This does not, however, prevent the attempt to know something of what is beyond; and in making the attempt, there are many facts which serve as bases for inductions, or at least theorizings, as to the condition of the interior of the globe. As the conclusions depend upon the balancing of evidence, upon the value given to one set of facts as set against another, they will differ according to the importance given by each individual to the one or other set of facts.

The long entertained opinion of the existence of a central heat seems to be on the whole fairly established, and upon such facts as these: 1. There is a regular and gradual increase in the temperature of all deep mines, equal to 1° F. for every 55 ft. of descent after the first 100. 2 Deep wells have always a high temperature. This has been carefully determined in artesian wells, not only by applying the thermometer to the water at the surface which has risen from a known depth, but also by sinking the instrument to various depths. The results have shown an increment similar to that exhibited in mines. Hot or boiling natural springs rise through great and deep fissures. 3. Igneous rocks—that is to say rocks which have cooled from a state of fusion by heat—invariably come from below, upwards, and thus testify to an amount of internal heat able either to retain these rocks in a state of fusion, or to convert them into a fluid condition before their ejection. 4. Physics also contributes important evidence. The specific gravity of granite or basalt is scarcely 3, while that of the earth, according to

the recent experiments of Airy, is about 6½. If unopposed, the influence of gravitation would so increase the density of the composing rock as to give a greater specific gravity for the earth than 6½. There must, then, be some expansive force acting to reduce the gravity, and the only force with which we are acquainted that could so act, is heat. On the other hand, physics raises difficulties which militate against the fluid condition of any considerable portion of the earth's interior, and in these difficulties it is supported by astronomy. But although we may admit that the rate of increase of heat from the surface downwards goes on at the rate indicated by observation in mines and wells, we need not draw the conclusion that the interior is fluid below 25 m., or even 2,000 m.; for we are ignorant of the effects of enormous pressure in altering the point of fusion.

The strict province of geology is the observed or observable portion of the earth's crust. The early geologists were no more than geognosts—they observed and described the rock-mineralogy of districts, and thus laid the foundations for those generalizations which have raised geology to its present position. The materials of the earth's crust were at first grouped together according to their composition, structure, and origin; but gradually it became evident that the rocks themselves occurred in groups, and that they had a particular order in nature; until at last, all the sedimentary strata were arranged in a single continuous and chronological series, from characters drawn less from their lithological structure than from their organic contents. Both systems of classification are important—that of the geognost as well as that of the modern geologist. The one is the result, to a large extent, of work in the laboratory and the study, and may be accomplished by the examination of hand specimens; the other must be determined in the field, and only from the examination of rocks in the mass, and in their natural position. The term lithology has been applied to the one aspect, while stromatology (*strōma*, a layer) may with equal fitness be given to the other.

Lithology.—All rocks are either igneous or sedimentary; that is, have either been produced by the action of heat, or been arranged by mechanical or other means in layers or beds.

I. The igneous rocks differ amongst themselves in their composition, structure, and age; they are made up of different materials; they have various textures, as granular, compact, or glassy; and they have been ejected at different periods of the earth's history. From these characteristics, they have been grouped thus: 1. The volcanic rocks (q.v.), comprising all that have been formed during the present and tertiary periods, and which are popularly known as lavas and volcanic ash. They have been ejected from volcanoes either in a fluid state, spreading over the land, and cooling as compact lavas; or spreading below shallow water, and becoming vesicular pumice, or as ash scattered in layers over the country; or they have risen into cracks and crevices of rocks as dykes and veins. Their principal constituents are feldspar and augite, and the different varieties depend on the predominance of the one or other of these ingredients. The feldspathic lavas are generally light-colored, and have a rough prickly feel to the finger. The chief varieties are trachyte, pearlstone, phonolite, obsidian, and pumice. The augitic lavas are of a dark-green or black color, weathering brown externally, and are generally heavier than the feldspathic lavas. The most common forms are dolorite, basalt, and leucite. 2. The trappean rocks (q.v.), which generally belong to the primary and secondary strata, and are composed of the same materials as the volcanic rocks, except that the silicates of magnesia and lime crystallize in the latter as augite, while they assume the more obtuse form of hornblende in the trappean rocks. Trap-rocks are always associated with a pipe or dyke connecting them with the underlying mass from which the materials were obtained. They have either overflown the surface, and formed a bed conformable to, and contemporaneous with the subjacent strata, or inserted themselves between already formed strata, forming injected sheets that are not contemporaneous. The predominance of the one constituent material over the other gives the basis for grouping the trappean rocks into the feldspathic traps, which are light-colored and generally compact rocks, the chief varieties being feldstone and pitchstone, and hornblendic traps or greenstones, containing the most abundant and best known rocks of this division. They are of a greenish color, varying from very light, when the feldspar is white and abounding, to almost black, when the constituent minerals are finely divided and colored with iron. In texture, also, there is considerable difference, some being fine-grained and compact, while in others the crystalline structure is very evident. The principal varieties are greenstone, basalt, and melaphyre. Porphyry occurs in both the volcanic and trappean rocks when the feldspar is aggregated in large and evident crystals, scattered through the body of the rock. 3. The granitic rocks (q.v.). The striking characteristic of these rocks is the abundance of silex in a separate and uncombined state as pure quartz. Granites are associated with the primary strata; they form also the support of the sedimentary deposit, wherever their base has been exposed to view. They occur in beds overspreading the sedimentary deposits or intercalated with them, in dykes, or as the apparent fundamental and unstratified rock. The chief varieties are true granite, syenite, and protogene.

II. The sedimentary rocks occur in layers or strata. They are either aqueous, aërial, chemical, or organic in their origin. 1. The aqueous rocks (q.v.) are argillaceous (q.v.), composed more or less of clay, as kaolin shale and clay slate; or arenaceous (q.v.), in which the constituent portions are so large as to be evident to the eye, as in sandstone.

The aqueous rocks were deposited in thin layers, which, however, frequently cohere, so as to form solid masses or beds of considerable thickness. Originally deposited horizontally, they have in many cases been subjected to disturbances that have elevated or depressed them; hence have arisen faults (q.v.) and dislocations (q.v.), as well as the exposing of the edges of the strata on the surface of the earth (strike, q.v.) at various angles (dip, q.v.). 2. The aërial rocks, which cannot be easily separated from aqueous rocks, except by their anomalous stratification (see DRIFT). They play so important a part on sandy coasts and arid interiors at the present day, that it cannot be doubted that they helped in former periods to bring the earth into its present condition. 3. The chemical rocks have been formed by the evaporation of liquids containing substances in solution. The materials thus deposited are salt, gypsum, lime, and silex. Salt is generally associated with gypsum, and occurs in a great range of formations from the Devonian or carboniferous, up to the most recent. The salt mines at Northwich, in Cheshire, belong to the triassic period. Rock-salt occurs in a coarsely crystalline mass, generally colored with iron, and more or less mixed with clay and other impurities. The deposits are often of great thickness, but apparently of limited extent, and were probably precipitated in isolated brine-lakes. Gypsum seems to have been formed under similar circumstances. It is abundant in the magnesian limestone, in the London clay, and in the Paris basin. Lime has not been deposited in masses, like gypsum, but only from the exposure to the atmosphere of small quantities of liquid saturated with it, which, by evaporation, have left stalagmitic or tufaceous deposits. Silicious sinter has been deposited in a similar manner as it is at the present day around the hot springs of Iceland. 4. The organic rocks are those which have been entirely, or to a large extent, formed from the remains of animals—as chalk and other more compact limestones—or vegetables, as coal, lignite, and diatomaceous deposits.

Changes are continually taking place in the sedimentary rocks, altering their structure and texture. Among the chief agents including these metamorphic changes are chemical attraction, the infiltration of water, the pressure of the superincumbent strata, and above all, heat and magnetism. Some of the older strata have been so much altered that they are generally spoken of as metamorphic rocks (q.v.).

Stromatology.—We apply this title to that division of geology which considers the stratified rocks in their chronological order, as exhibiting different phases of the history and development of the globe itself, and in their fossil contents setting forth the progress of life upon its surface. Referring to the article PALÆONTOLOGY for a notice of the animal and vegetable organisms that have been preserved in the rocks, we shall here give a rapid sketch of the various periods in the earth's geological history.

The original, and, as it is supposed, molten condition of the globe is hid in mystery and uncertainty. The geologist takes up the history at the point where air and water make their appearance, and where the inorganic substances were subject to the same influences as those now in operation. It is very doubtful whether the fundamental crust is in any place exposed or has ever been uncovered by man. The earliest rocks observed, though probably not the oldest, are those described by Logan as the *Laurentian system* (q.v.). The typical beds occur in Canada; strata of the same age were subsequently detected in Scotland by Murchison and Geikie. The strata have been very much metamorphosed by the action of heat, and by the many chemical and physical forces which heat has set in motion, so that their original condition is entirely altered, the whole series being converted into gneissose strata. A structure supposed to represent a great foraminifer (*Eozoon Canadense*) has been detected in these rocks, as well as indistinct traces of other fossils. Even in the succeeding *Cambrian series* (q.v.), fossils are very rare, consisting of a few zoophytes, crustaceans, and annelids. The rocks of this period consist of thick masses of sandstones and slates or shales. The *Silurian period* (q.v.) is represented by immense marine deposits, which in some districts are rich in the remains of invertebrate animals, while other extensive tracts have not yielded a single fossil. No certain evidence of plants has yet been observed, except the round spore-cases in the upper transition beds, yet the economy of life would require then, as now, oxygen producers and carbonic acid consumers. Perhaps the anthracite of the graptolitic shales, and the oil from the bituminous silurian shales of North America, may be in part or in whole of vegetable origin. The first traces of the existence of dry land occur in the *old red sandstone* (q.v.). The great mass of the strata of this period consist of immense thicknesses of limestone, composed of corals and shell-fish, of beds of shale and of sandstone, crowded in some places with fish-remains. A few land-plants and air-breathing animals, the tenants of the dry land, are preserved in the strata of the middle and upper divisions. The *carboniferous measures* (see CARBONIFEROUS SYSTEM) are ushered in by a great thickness of deep-sea limestone. The coal-bearing strata are alternately sea, estuary, or lake deposits of sandstone, shale, and limestone, and dry land surfaces with the vegetation converted into coal. The waters teemed with fishes of great size and strange form; and the dry land was covered with a rank and luxuriant vegetation of ferns and coniferous trees, and strange forms like gigantic mares' tails and club-mosses. A few air-breathing reptiles and shells have been found in these strata. The *permian period* (q.v.) exhibits a group of organisms differing little from those of the preceding epoch, with the exception of a few added reptiles.

The permian strata are sandstones, gypseous marls, and common and magnesian limestones.

With these beds terminate the palæozoic rocks. Before the commencement of the secondary epoch, great disturbances and depressions took place in the districts whose geological structure has been examined; and at the same time a great change took place in the character of the animal and vegetable life.

The typical rocks of the *triassic period* (q.v.), the earliest of the secondary epoch, exist in Germany. They are highly fossiliferous, containing the remains of marine animals of various kinds. In Britain, the rocks are chiefly red sandstones and red marls, the coloring matter of which seems to have been destructive to life; the only fossils they contain are a few land-plants, and some footprints and fragments of bones of reptiles.

The *lias* (q.v.), which follows, and forms the base of the oolite formation, consists of extensive clay deposits, with argillaceous limestones and sandstones—strata which indicate the existence of large tracts of land. The contained fossils have a mixed land, fresh-water, and sea character. With considerable numbers of plants and insects, there are also marine brachiopods and cephalopods, and the remarkable swimming reptiles, that are so perfectly preserved as to supply materials for nearly perfect restorations.

The *oolite series* (q.v.) consists of alternating beds of limestone and clay, with very little intervening sandstone. The abundance of dry land is testified to by the number and variety of the air-breathing fossils (amongst which mammalia appear for the first time), and even by the occurrence of strata that have been ancient soils. The group is highly fossiliferous.

The *cretaceous strata* (see CRETACEOUS GROUP), which, as a whole, have had a deep-sea origin, are introduced by fresh-water and estuary deposits, showing that great tracts of land were traversed by mighty rivers actively abrading and carrying off materials for delta deposits. The life of the period was abundant. The immense thicknesses of chalk, which give the name to the group, are composed to a very large extent of the perfect or comminuted shells of foraminifera and molluska. Besides these, land-plants, fresh-water and marine shells and fish, and large terrestrial and marine reptiles, occur. Birds and mammalia have not yet been observed, but it is most probable that they did exist, as they have been found in older strata.

In passing to the tertiary epoch, there is not found so striking a change in the life of the globe as that which characterized the division between the paleozoic and secondary strata. From the thias, the fossils have been gradually assuming the appearance of existing organisms: many strange forms have existed and passed away without leaving representatives in the later strata or in the living inhabitants of the earth. Still, the *facies* of the organic remains gradually approaches that of the present fauna and flora, until the *eocene period* (q.v.), when some fossils appear, which, if not identical with recent species, so nearly approach them, as to make it impossible to distinguish them. The proportion of such species is from 3½ to 5 per cent. The seas in which the eocene beds were deposited were comparatively small, and consequently the deposits occur in scattered and isolated basins. The earlier strata are marine, but towards the middle of this period they become lacustrine or fluviatile.

The *miocene period* (q.v.) is said to contain above 25 per cent of living forms. It is doubtful whether there are in Britain any true representatives of this period. The strata are largely developed in France and Belgium. Besides abounding in marine molluska, the miocene strata contain the remains of many large mammalia. The deposits of the *pliocene period* (q.v.) contain from 50 to 70 per cent of existing forms. The strata are marly sands and gravels abounding with sea-spoils.

In the *pleistocene strata* (q.v.) the proportion of existing forms is still greater—indeed, all the principal generic forms now alive, except man, seem to have been in existence during this period. The strata consist of the sands, gravels, and boulder clay left by glaciers and icebergs, of marls and raised sea-beaches.

The newer strata belong to the human period, and have been, and are continuing to be, formed by agents now in operation. They contain the remains of species of plants and animals which still live on the globe.

GEOLOGY (*ante*). The earth is covered, either wholly or partly, by two envelopes; the first, outer, of gas, surrounding all; the second, inner, of water, covering about three-fourths of the globe; within these is a globe solid and cold on the surface, but in the interior of exceedingly high temperature. The atmosphere reaches to an altitude variously estimated from 40 to 500 m., its density growing more and more attenuated. Its height varies with latitude and by reason of unequal pressure, but it is greatest at the equator and least at the poles. It is believed that the oxygen which now forms half of the surface-matter of the earth was originally a part of the atmosphere, and that the beds of coal forming so considerable a part of the earthy deposit represent the carbonic acid then in the air. So, too, the chlorides in the sea were doubtless carried down from the atmosphere in the condensation of aqueous vapor. It is the opinion of many scientists that the prolific flora of the carboniferous period is evidence of a temperature and moisture much greater than in recent ages. At present, the atmosphere is a mixture of 21 parts, by weight, of oxygen, and 79 of nitrogen, with a very small pro-

portion of carbonic acid, and still smaller quantities of other substances. The minor constituents vary in various places; there is less carbonic acid in the air over the sea; oxygen diminishes and carbonic acid increases in the air of villages and cities. Although the carbonic acid forms but four one-hundredths of one per ct. of the air, its total amount probably exceeds what would be disengaged if all the animal and vegetable matter on the earth surface should be burned. Vapor of water is the most important of the minute substances in the atmosphere, but its quantity varies, according to temperature, from 4 to 16 grains in 1,000 grains of air. The lower the temperature, the less the capacity for vapor. This vapor, condensed, becomes dew, rain, hail, or snow. Rain brings with it from the atmosphere minute quantities of the chlorides of sodium, potassium, magnesium, and calcium; of the sulphates of soda, potash, lime, and magnesia, and traces of ammonia and various salts; but, in quantity, chloride of sodium is nearly equal to all the others combined. That powerful form of oxygen, ozone, is always present in minute quantities in the air. The organic substances in the air are sometimes living germs, of which some may lead to the propagation of disease. The air of towns is especially impure, particularly where much coal is burned.

Three-quarters of the surface of the earth is water, of greatly varying depth, temperature, and action. From the half-inch ripple along the shelving shore, the sea goes down (as far as sounded) to a depth of more than 5 English miles. Recent investigation shows that the Atlantic has an average depth of from 2 to 3½ miles. It is assumed that the average depth of all seas combined is about 3 m., or say 16,000 feet. The density of sea-water is about 1026, owing to salts held in solution; and it is concluded that the sea-water has always been salt. It is also thought that the composition of the sea, like that of the air, has been subject to gradual change through the geological periods, and that it has reached its present condition after ages of slow transmutation. There is evidence that large quantities of lime, silica, chlorides, and sulphates, have, in the course of time, been removed from the waters of the sea in the secretions of its animal inhabitants. At the same time, the sea has constantly received from the land mineral matters in solution. Every spring, brook, and river, removes salts from the earth, and these salts ultimately find their way to the sea. Therefore, the waters of the ocean contain, in some proportion, every substance that water can dissolve, and probably every element present in the outer shell of the globe. In consequence of these additions, the water of the ocean is gradually growing more and more salt. Inclosed seas, like the Baltic, receiving much water, and having little loss by evaporation, are less salt than the great oceans. If the evaporation be great, the saltness becomes intense, as in the Caspian, and even in the Mediterranean, which holds one-sixth more than the ocean average of saline ingredients. The mineral constituents of the ocean show the following averages:

	Per cent.		Per cent.
Chloride of sodium	75,786	Sulphate of magnesia	5,597
Chloride of magnesium	9,159	Bromide of sodium	1,184
Chloride of potassium	3,657		
Sulphate of lime (gypsum)	4,617		100,000
		Per ct. of salts in sea-water	3,527

There are also traces of iodine, silica, fluorine, phosphoric acid, carbonate of lime, silver, arsenic, lead, and copper. Sea-water also contains from 2 to 3 per ct. of atmospheric gases. The proportion of oxygen is greater, and that of the carbonic acid least, in the surface-water. It has been calculated that sea-water contains 30 times more carbonic acid than does fresh water.

Enveloped in the atmosphere and the ocean, lies the solid globe. Its density is put at 5½; that is, as a whole, it is 5½ times heavier than a globe of water of the same size. The average density of the surface-matter of the earth is from 2½ to 3, and its mean density is twice that of the outer part. The old theory that the interior of the earth is intensely hot, and all the materials are in fusion, has been much disputed, and, by many, abandoned. Still, the term "crust" is used to denote the outer surface, or such parts as are accessible to observation. Chemical research has discovered 64 simple, or, as yet, indecomposable, bodies or elements, in various proportions and compounds, in the accessible part of the crust. But many of them are of rare occurrence, and the crust is mainly composed of 16, which in the following tables are arranged in groups:

Metalloids.	Atomic Wt.	Metals.	Atomic-Wt.
Oxygen	15.96	Aluminium	27.80
Silicon	28.00	Calcium	39.90
Carbon	11.97	Magnesium	23.94
Sulphur	31.98	Potassium	39.04
Hydrogen	1.00	Sodium	22.99
Chlorine	35.37	Iron	55.90
Phosphorus	30.96	Manganese	54.80
Fluorine	19 10	Barium	136.80

Oxygen is the most abundant of all these elements, making 21 per cent by weight of the air, nearly 89 per cent of water, and about one-half of all the known rocks on the globe.

Silicon, always united with oxygen, is next in abundance, and silica, alone or in combination with metallic bases, constitutes one-half of the known mass of the globe. Of the metals, aluminium is the most important, and with silicon and oxygen forms the basis of most of the crystalline rocks. Iron is the great source of color, most of the yellow, brown, red, and green hues of the rocks being due to its presence. The 16 elements named in the foregoing list make up 99 per cent of the earth's crust; the other one-hundredth part embraces the gold, silver, copper, etc.; indeed all the metals except iron. So far as we know, the outer portion of our planet consists mainly of metalloids, and its metallic constituents have in great part entered into combination with oxygen, so that the atmosphere contains the residue of that gas which has not united itself in mineral compounds.

As for the interior or nucleus of the globe, we must reason about its construction from what we know of the crust, of the irregular distribution of materials, and the distribution of land and water. That the southern hemisphere is nearly covered with water seems to show an excess of density in that section of the globe. Evidently the central mass of the earth must be very dense; since the average density of which is much greater than that of the crust, and this greater density would be a natural, if not a necessary, result of the pressure of the superincumbent crust upon the central mass. That there is in many places, perhaps everywhere, a high degree of temperature in or under the crust of the earth, is manifested by so many proofs that it cannot be doubted. Nature shows it in extinct and active volcanoes, and thousands upon thousands of springs of hot water. Man has discovered the same fact in digging mines and boring wells. Winter's cold and summer's heat may be regarded as following each other in successive downward waves which disappear at a limit where the temperature remains constant. This zone of constant temperature is believed to lie between 60 and 80 ft. below the surface of the earth in the temperate regions; but near the city of Yakutsk, in Siberia, 62° n., the ground is constantly frozen to a depth of 700 ft.; in the island of Java, a constant temperature is found at a depth of 2 or 3 feet. Below the limit of the influence of ordinary seasonable changes, the temperature is nowhere found to diminish downwards. There are exceptional cases, but they are all explainable. Near hot springs or volcanoes special agencies of lava, etc., may produce an abnormal subterranean temperature, and thousands of years may pass before the restoration of thermal equilibrium. Again, masses of ice and snow over the surface for thousands of years would so depress the temperature that it would require ages to recover. But beneath the limit to which the influence of the seasons extend, observations in most parts of the globe show that the temperature invariably rises as we go towards the interior of the earth. This increase is estimated to be one degree Fahrenheit for every 50 or 60 ft. of depth. Experiments, however, show remarkable deviations, between 83 ft. in the coal measures near Manchester, Eng., to 41 ft. in coal measures near Glasgow. In the famous artesian well at Grenelle, near Paris, 1800 ft. deep, the increase is a degree for 57 ft.; the same is found in the well at Mendorff, near Luxembourg, 2,400 ft. deep. But there are variations in the increment of downward heat due to the varying conductiveness of rocks at or near the surface. For instance, the resistance of opaque white quartz is expressed by 114; that of basalt by 273; and that of cannel coal at 1588, or 13 times more than that of quartz.

Many theories have been propounded concerning the condition of the interior of the earth, but prof. Geikie considers only three of them worthy of serious consideration. The first supposes the globe to consist of a solid crust and a molten interior. The second holds that, with the exception of local vesicular spaces, the globe is solid to the center. The third contends that while the mass of the globe is solid, there lies a liquid substratum near the crust. In favor of the first theory, the arguments are: The ascertained rise of temperature, which at a depth of 50 m. would become 4,600° Fahrenheit—more than enough to melt platinum, the least fusible of metals; the existence of volcanoes throwing out molten rocks, and presumably fed from the great interior fire; the fact that the products of volcanoes, no matter how widely separated, show almost complete uniformity in character; the earthquakes, which are inexplicable except upon the supposition of a thin and flexible crust. Of course all these arguments are *a posteriori*, or inferential; but they have been strongly urged by geologists as the only views compatible with geological evidence. The arguments against the internal fluidity of the earth are based upon physical and astronomical considerations. First, the argument from the precession of the equinoxes, and nutation. In 1839, Mr. Hopkins of Cambridge endeavored to calculate how far the planetary motions of nutation and precession would be influenced by the solidity or liquidity of the earth's interior. His conclusions indicate that these movements could not be as they are if the globe consisted of a central ocean of molten matter, surrounded with a crust 20 or 30 m. thick; that the least thickness consistent with the actual movements must be from 800 to 1000 m., and that the whole might be solid to the center with the exception of comparatively small vesicular spaces filled with melted rock. The assumption of a comparatively thin crust requires that the crust shall have such perfect rigidity as is possessed by no known substance. The tide-producing force of the sun and the moon exerts such a strain upon the substance of the globe, that it seems impossible that the planet could maintain its shape unless the supposed crust were at least 2,000 or 2,500 m. in thickness. The conclusion

is reached that the mass of the earth is on the whole more rigid than a continuous solid globe of glass of the same diameter. The second argument is from the tides, which are explicable only on the theory that the earth is solid to the center or has a crust deep enough to make it practically so, that is 2,500 m. or more. The third argument is based on the relative densities of melted and solid rock. The earth's central mass may be supposed to be metallic, or of some substance equally heavy. Into this dense mass the comparatively light crust could not sink, though its earliest formed portions would no doubt descend until they reached a stratum whose specific gravity agreed with their own.

The Age of the Earth is discussed from geological and physical standpoints. Taking the geological view we must remember that we do not know that changes going on now were going on in the same way millions of years ago; the conditions might have been different, and the changes vastly more rapid; but assuming stratified deposits to have been going on at the present rate for an indefinite period, one writer puts down 60,000,000 of years as the least probable age of the globe. In the stratified rocks we have abundant proof that the whole fauna and flora of the earth's surface have passed through many revolutions, species, genera, and families have appeared and vanished many times in succession. On any supposition it must be admitted that these vicissitudes in the organic world can have been effected only during vast periods of time, though no trustworthy standards seem to be available whereby these periods are to be measured. The argument, from geological evidence, favors an interval of probably one hundred millions of years since the advent upon the earth of the earliest form of life and the beginning of the deposition of the oldest stratified rocks. The argument as to the age of the earth, based upon physics, assumes, first, the internal heat and rate of cooling of the globe; second, the tidal retardation of the earth's rotation; third, the origin and age of the sun's heat. With regard to internal heat Sir William Thompson concluded that the superficial consolidation of the globe could not have occurred less than 20,000,000 nor more than 400,000,000 years ago. The argument from tidal retardation proceeds on the admitted fact that, the rotation of the earth is retarded by the friction of the tide wave, and is therefore much slower than it was ages ago. The argument based on the sun's heat is hardly to be depended upon; the time during which the sun has lighted the earth has been estimated at fifteen millions, and at a hundred millions of years. The latter estimate is amply sufficient for all the purposes of geology.

Dynamical geology discusses the processes now in action upon the earth, whereby changes are made in the structure and composition of the crust; in the relations between the interior and the surface, as shown by volcanoes, earthquakes, and other terrestrial disturbances; in the distribution of oceans and continents; in the outlines of the land, and the form and depth of the sea-bottom; in climate; and in the races of plants and animals by which the earth is tenanted. It brings before us all the activities which it is the province of geology to study. The range of operations included within the space of inquiry in this branch of the science may be regarded as a vast cycle of change, into which we may break at any point and around which we may travel, only to find ourselves brought back to the starting point. Before any of the periods of which a record remains in the visible rocks, the chief source of geological action probably lay within the earth itself. The planet still retained much of its initial heat, and was doubtless the theater of great chemical changes, giving rise, perhaps, to manifestations of volcanic energy like those which have so marvelously roughened the surface of the moon. As the outer layers of the globe cooled, and the disturbances due to internal heat and chemical action became less marked, the influence of the sun, which must have always operated, would be relatively more efficient, causing a wide circle of superficial changes wherein variations of temperature and the circulation of air and water over the earth come into play.

While inquiring into the history and the present condition of the earth the geologist must keep his mind open to the reception of evidence for kinds and degrees of action which he has not imagined. Human experience has been too short to allow the assumption that the causes and modes of geological changes have been definitely ascertained. Future discovery may produce evidence of former operations by heat, magnetism, chemical change, or otherwise, which may explain many of the phenomena with which geology has to deal. Of the influences, so many and so profound, which the sun exerts upon our planet, we can as yet perceive but little; nor can we tell what other cosmical influences may have given their aid in the evolution of geological changes. In the present state of our knowledge all the geological energy upon and within the earth must be traced back to the parent sun. There is, however, propriety and convenience in distinguishing that part of it which is due to the survival of some of the original energy of the planet, and that part which rises from the present supply of energy received day by day from the sun. In the former case we have to deal with the interior of the earth and its reaction upon the surface; in the latter we deal with the surface of the earth, and to some extent with its reaction on the interior. This distinction affords an opportunity to treat the subject under two divisions:

I. *Hypogene, or Plutonic Action;* the changes within the earth caused by original internal heat and by chemical action.

II. *Epigene, or Surface Action;* the changes produced on the superficial parts of the earth, chiefly by the circulation of air and water set in motion by the sun's heat.

In considering hypogene action we must call to mind a globe still intensely hot in its interior, radiating heat into space, and contracting in bulk. Molten rocks from the interior are from time to time poured out upon the surface; wide areas are raised up or sunk down; and in these movements remarkable changes are produced upon the rocks of the crust; they are broken, rendered crystalline, and sometimes fused. (See VOLCANOES.)

In the case of *Earthquakes*, the earth-wave or wave of a shock underneath a country may traverse a wide region and affect it violently at the time without leaving any trace of its passage. Loose objects, however, are apt to be displaced. Thus blocks of rocks already disengaged from their parent masses may be rolled into valleys. Landslides may be produced, making changes in the courses of streams. Fissures are made in the soil, from the size of tiny crevices to wide chasms. Trees may be thrown down and buried, and the surface of the region may be radically changed. But in a few years these superficial effects may be effaced by the leveling power of the atmosphere. In New Zealand, in 1848, an earthquake fissure 18 inches wide was traced for 60 m., and in 1855 another was made of 90 m. in length. Remarkable circular cavities are sometimes formed in the ground during the passage of the earth-wave. In many cases these holes serve as funnels for the escape of water. They are believed to be caused by the collapse of subterranean water-channels and the consequent forcible ejection of water to the surface. Springs are affected by earthquake movements, becoming more or less in volume, discolored, or muddy, and increasing or diminishing in temperature; and brooks and rivers are accelerated or stopped. Lakes rise or fall at great distances from the center of disturbance. When the earthquake occurred at Lisbon many of the lakes in central and north-western Europe were so affected as to maintain a succession of waves two or three feet above their usual level.

In some cases lakes have become dry ground, and dry ground lakes. The great sea-wave propagated outward from the center of a sub-oceanic earthquake, and reaching the land after the earth-wave has arrived there, gives rise to much destruction along the maritime parts of the disturbed region. As it approaches the shore, the littoral waters retreat seaward, sucked up, as it were, by the advancing wall of water, which, reaching a height of sometimes 60 ft., rushes over the bare beach and sweeps inland, carrying with it everything which it can dislodge and bear away. Loose blocks of rock are thus lifted to a considerable distance from their former position, and left at a higher level. Deposits of sand, gravel, and other superficial accumulations are torn up and swept away, while the surface of the country, as far as the limit reached by the wave, is strewn with débris. If the district has been already shattered by the passage of the earth-wave, the advent of the great sea-wave augments and completes the devastation. It has been observed, after the passage of an earthquake, that the level of the disturbed country has been changed. Thus after the terrible earthquake of Nov. 19, 1822, the coast of Chili for a long distance was found to have risen from 3 to 4 ft., so that along the shore the littoral shells were exposed, adhering still to the rocks, amid multitudes of dead fish. The same coast-line has since been further upraised by subsequent earthquake shocks. On the other hand, many instances have been observed where the effect of the earthquake has been to depress permanently the disturbed ground. For example, during the Bengal earthquake of 1762, an area of 60 m. on the coast, near Chittagong, suddenly went down beneath the sea, leaving only the tops of the higher eminences above water. The succession of earthquakes, which in the years 1811 and 1812 devastated the basin of the Mississippi, produced wide depressions of the ground, over some of which the river spread so as to form new lakes, with the tops of the trees still standing above the surface of the water.

An earthquake shock has been defined by Mr. Mallet as the transit of a wave of elastic compression through the crust and surface of the earth, generated by some sudden impulse within the crust. The passage of such a wave has been imitated experimentally, and some of its characteristic features have been illustrated by accidental explosions at powder-works. But though the phenomena point to some sudden and violent blow inflicted upon the crust, it is impossible to do more than speculate on the probable nature of this blow. In some cases it may arise from the sudden flashing into steam of water in the spheroidal state; from the sudden condensation of steam; from the explosion of a volcanic orifice; from the falling in of the roof of a subterranean cavity: or from the sudden snap of subterranean rocks subjected to prolonged and intense strain. But we are still in ignorance as to the actual immediate cause of any earthquake in regions remote from active volcanoes. This, at least, is certain, that the shock must arise from some sudden and violent impulse, whereby a wave or undulation is propagated in all directions through the solid substance of the crust.

Besides the sudden movements due to earth-shocks, the crust of the earth undergoes, in many places, *oscillations* of an extremely quiet and uniform character, sometimes of an elevatory, sometimes of a subsiding nature. So tranquil are these changes that they produce from day to day no appreciable alteration in the aspect of the ground affected. Only after the lapse of several generations, and by careful measurements, can they be proved. Indeed, in the interior of a country nothing but a series of accurate levelings from some unchanged datum-line might detect the change of level, unless the effects of this terrestrial movement showed themselves in altering the drainage. It is only along

the sea-coast that a ready measure is afforded of any such movement. In popular language it is usual to speak of the sea as rising or sinking relatively to the land. But so long as the volume of the ocean remains the same, the general sea-level can neither rise nor fall, unless by some movement of the solid globe underneath it. And, as we cannot conceive of any possible augmentation of the oceanic waters, nor of any diminution, save what may be due to the extremely slow process of abstraction by the hydration of minerals, or absorption into the earth's interior, we are compelled to regard the sea-level as furnishing a practically constant datum-surface, any deviation from which, in the apparent heights of sea and land, must be due to movement of the land and not of the sea. There are, indeed, certain cosmical causes which may affect the relative levels of sea and land. Thus the accumulation of immense masses of snow and ice as an ice-cap at one of the poles would tend to displace the earth's center of gravity, and as a consequence, to raise the level of the ocean in the hemisphere so affected, and to diminish it in a corresponding measure elsewhere. The return of the ice into the state of water would produce the opposite effect. Dr. Croll has also drawn attention to the fact that, as a consequence of the diminution of the centrifugal force, owing to the retardation of the earth's rotation caused by the tidal wave, the sea-level must have a tendency to subside at the equator and rise at the poles. A larger amount of land need not ultimately be laid bare at the equator, for the change of level resulting from this cause would be so slow that the general degradation of the surface of the land might keep pace with it, and diminish the terrestrial area as much as the retreat of the ocean tended to increase it. Dr. Croll has further pointed out that the waste of the equatorial land, and the deposition of the detritus in higher latitudes, must still further counteract the effects of retardation and the consequent change of ocean-level. Such widespread general causes of change must produce equally far-reaching effects. But in examining the changes of level between land and sea, we find them to be eminently local and variable in character, pointing to some local and unequally acting cause—so that, while admitting these cosmical and widespread influences to be part of the general system of geological change, we must yet hold the sea-level, for all practical purposes, to be invariable, any apparent oscillations of that level upon the land being due to terrestrial movements.

Various maritime tracts of the land have been ascertained to have undergone in recent times, or to be still undergoing, a gradual elevation above the sea. Thus the coast of Siberia for 600 m. to the e. of the river Lena, the western tracts of South America, and the Scandinavian peninsula, with the exception of a small area at its southern apex, have been proved to have been recently upheaved. The proofs of this change of level chiefly to be relied on are the following: (1) The position of rocks covered with barnacles or other littoral adherent animals, or pierced by lithodomous shells. A single stone with these animals on its surface would not necessarily prove anything, for it might be cast up by a storm; but a line of large bowlders, which had evidently not been moved since the cirripedes and mollusks lived upon them, and still more a solid cliff with these marks of littoral or sub-littoral life upon its base, now raised above high-water mark, would be sufficient to demonstrate a rise of land. The amount of the upheaval might be determined with sufficient accuracy by measuring the vertical distance between the upper edge of the barnacle zone upon the upraised rock, and the limit of the same zone on the present shore. (2) A line of sea-caves, now standing at a distance above high-water mark beyond the reach of the sea, would afford evidences of recent uprise, since caves of this kind are hollowed out only by the waves between tide-marks. (3) One of the most striking proofs of upheaval is furnished by what are termed "raised beaches." A beach is the space between tide-marks, where the sea is constantly busy depositing sand and gravel, mingled with the remains of shells and other organisms, sometimes piling the deposits up, sometimes sweeping them away into the more open water. The terrace or platform thus formed is a well-marked feature of coast-line skirting tidal seas. When the land rises with sufficient rapidity to carry the line of littoral deposits above the reach of the waves, the flat terrace thus elevated is known as a raised beach. The former high-water mark then lies inland, and while its sea-worn caves are in time hung with ferns and mosses, it furnishes itself an admirable platform, on which meadows, fields, and gardens, roads, houses, villages, and towns spring up, while a new beach is made below the uplifted one. Raised beaches abound along many parts of the coast-line of Britain. Some excellent examples occur in Cornwall and Devon. The coast-line on both sides of Scotland is fringed with raised beaches, sometimes four or five occurring in succession at heights of 25, 40, 60, 75, and 100 ft. above the present high-water mark. Such beaches can be traced also in the valley of the Connecticut river in western Massachusetts. Each terrace marks a former lower level of the land with regard to the sea, and probably a lengthened stay of the land at that level, while the differences of level indicate the vertical amount of each successive uplift of the land, and show that the land in its upward movement did not remain long enough at intermediate points for the formation of terraces. A succession of raised beaches, rising above the present sea-level, may therefore be taken as pointing to a former prolonged upheaval of the country, interrupted by long pauses, during which the general level did not materially change. (4) Any stratum of rock containing marine organisms, which have manifestly lived and died where their remains now

lie, must be held to prove upheaval of the land. In this way it can be shown that most of the solid land now visible to us has once been under the sea. Even high on the peaks of the cliffs and the flanks of the Himalaya mountains, undoubted marine shells occur in the solid rocks. (5) In countries which have been long settled by a human population, it is sometimes possible to prove, or at least to render probable, the fact of recent uprise of the land by reference to tradition, to local names, and to works of human construction. Piers and harbors, if now found to stand above the upper limit of high-water, furnish indisputable evidence of a rise of land since their erection.

It is more difficult to trace the downward movement of the land, for the evidence of each successive sea-margin is carried down, and washed away or covered up. Nevertheless, the fact of subsidence can be satisfactorily established by the following kinds of proofs: (1) The results of mere erosion by the sea and those of actual depression of the level of the land cannot always be distinguished without some care. The encroachment of the sea upon the land, involving, it may be, the disappearance of successive fields, roads, houses, villages, and even whole parishes, does not necessarily indicate a sinking of the land. Such destruction of the coast-line may, indeed, be in progress without any actual change of level. Should the sea, however, rise to the level of roads and buildings which it never used to touch; should former half-tide rocks cease to show even at low-water, and should rocks, previously above the reach of the highest tide, be turned first into shore-reefs, then into hummocks and islets, we infer that the coast-line is sinking. Such kind of evidence is found in Scania, the most southerly part of Sweden. Streets, built of course above high-water mark, now lie below it, with older streets lying lower than they, so that the subsidence is of some antiquity. A stone, the position of which had been exactly determined by Linnæus in 1749, was found after 87 years to be 100 ft. nearer the water's edge. The w. coast of Greenland, for a space of more than 600 m., is perceptibly sinking. It has there been noticed that over ancient buildings on low shores, as well as over entire islets, the sea has risen. The Moravian settlers have been more than once driven to shift their boat-poles inland, some of the old poles remaining visible under water. (2) As the land is brought down within reach of the waves, its characteristic surface-features are apt to be effaced, so that the submerged area, which passes down beneath the sea, may retain little or no evidence of its having been a land-surface. It will be covered, as a rule, with sea-worn sand or silt. Hence, no doubt, the reason why, among the marine strata which form so large a part of the stratified portion of the earth's crust, and where there are many proofs of depression, actual traces of land-surfaces are comparatively rare. It is only under very favorable circumstances, as, for instance, where the area is sheltered from prevalent winds and waves, and where, therefore, the surface of the land can sink tranquilly under the sea, that fragments of that surface may be completely preserved under overlying marine accumulations. It is in such places that "submerged forests" occur. These are stumps or roots of trees still in their positions of growth in their native soil. Beds of peat, full of tree stumps, hazel-nuts, branches, leaves, and other indications of a terrestrial surface, are often found in similar situations. Sir Henry de la Beche has described, around the shores of Devon, Cornwall, and western Somerset, a vegetable accumulation, consisting of plants of the same species as those which now grow freely on the adjoining land, and occurring as a bed at the mouths of valleys, at the bottoms of sheltered bays, and in front of and under low tracts of land, the seaward side of which dips beneath the present level of the sea. Over this submerged land-surface sand and silt containing estuarine shells have generally been deposited, whence we may infer that in the submergence the valleys first became estuaries, and then sea-bays. If now, in the course of ages, a series of such submerged forests should be formed one over the other, and if, finally, they should, by upheaval of the sea-bottom, be once more laid dry, so as to be capable of examination by boring, well-sinking, or otherwise, they would prove a former long-continued depression, with intervals of rest. In such a case, the intervals of pause would be marked by the buried forests, and the progress of the depression by the strata of sand and mud lying between them. In short, as to a former protracted elevation followed by a long pause, the evidence would be strictly on a parallel with that furnished by a succession of raised beaches. 3. An interesting kind of proof of an extensive depression of the north-west of Europe is furnished by the deep fjords or sea-locks by which that region is indented. A fjord is a long, narrow, and often singularly deep inlet of the sea, which terminates inland at the mouth of a glen or valley. The word is Norwegian, and in Norway fjords are characteristically developed. The English word "firth," however, is the same, and the western coast of the British isles furnish many excellent examples of fjords. In Scotland they are usually called lochs, as loch Hourn, loch Nevis, loch Fyne, Gareloch; in Ireland they are sometimes known by the name of loughs, as lough Foyle, but more commonly by that of bays, as Dingle bay, Bantry bay. There can be little doubt that, though now filled with salt water, fjords have been originally land valleys. The long inlet was first excavated as a land-valley or glen. This valley exactly corresponds in form and character with the hollow of the fjord, and must be regarded as merely its inland prolongation. That the glens have been excavated by sub-aërial agents is a conclusion borne out by a great weight of evidence. If, therefore, we admit the sub-aërial origin of the glen, we must also grant a similar origin to its sea-

ward prolongation. Every fjord will thus mark the site of a submerged valley. This inference is confirmed by the fact that fjords do not, as a rule, occur singly. Like the glens of the land, they lie in groups; so that when they are found intersecting a long line of coast like that of the w. of Norway, or the w. of Scotland, we conclude that the land has there sunk down so as to permit the sea to run far up and fill the submerged glens. 4. Evidence of widespread depression over the area of the Pacific ocean is furnished by the numerous atolls, or coral islands, scattered through that vast expanse of water. Mr. Darwin ascertained that the reef-building corals do not live at a greater depth than about 15 or 20 fathoms. Yet reefs and circular islets of coral rise with nearly perpendicular sides from a depth of 2,000 ft. and upwards, until they reach the surface of the sea. As the corals could not have begun to grow upwards from such vast depths, Mr. Darwin first suggested that the sites of these coral reefs had undergone a progressive subsidence, the rate of upward growth of the reefs keeping pace, on the whole, with the depression. A fringing reef would first be formed fronting the land within the limit of the 20-fathom line. Growing upward until it reached the surface of the water, it would be exposed to the dash of the waves, which would break off pieces of the coral and heap them upon the reef. In this way islets would be formed which, by successive accumulations of materials thrown up by the breakers, or brought by the winds, would remain permanently above water. On these islets palms and other plants, whose seeds might be drifted from the adjoining land, would take root and flourish. Inside the reef there would be a shallow channel of water, communicating through gaps in the reef, with the main ocean outside. Fringing reefs of this character are of common occurrence at the present time. In the case of a continent they front its coast for a long distance, but they may entirely surround an island. If the site of a fringing reef undergoes depression at a rate sufficiently slow to allow the corals to keep pace with it, the reef will grow upward as the bottom sinks downward. The lagoon channel inside will become deeper and wider, while, at the same time, the depth of the water outside will increase. In this way a barrier reef will be formed. Continued slow depression must continually diminish the area of the land inclosed within one of these rings of coral reef, while the reef itself retains much the same size and position. At last the final peak of the original island disappears under the lagoon, and an atoll, or true coral island, is formed. Should any more rapid or sudden downward movement take place, it might carry the atoll down beneath the surface, as seems to have happened at the Great Chagos bank in the Indian ocean, which is a submerged atoll. It has recently been suggested that barrier reefs do not necessarily prove subsidence, seeing that they may grow outward from the land, upon a talus of their own débris broken down by the waves, and may thus appear to consist of solid coral, which had grown upward from the bottom during depression, although only the upper layer, 20 fathoms or thereabouts in thickness, is composed of solid, unbroken, coral growth. The explanation may doubtless account for some barrier-reefs, and for the way in which the steep seaward face of all such reefs is formed and maintained. But it does not elucidate the existence of submerged atolls, the presence of gaps in atolls answering to gaps in the fringing reefs opposite to the mouths of rivers: and the difficulty of supposing that, in a coral archipelago, there should have been scores of submerged peaks so nearly of the same height as to rise within 20 fathoms of the surface, and yet so seldom actually to tower above it. According to the simple and luminous theory of Mr. Darwin, every stage in the progress of the changes is open to observation, from the incipient fringing reef to the completed and submerged atoll. Every observed fact fits in harmoniously with the others, and we reach the impressive conclusion that a vast area of the Pacific ocean, fully 6,000 geographical miles from e. to w., has undergone a recent subsidence, and may be slowly sinking still. It by no means follows, however, as some writers have imagined, that the present Pacific ocean occupies the site of a vast submerged continent. All the coral islands seem to have been built on volcanic peaks. Wherever any non-calcareous rock appears it is of volcanic origin. We must therefore conceive of these oceanic islands as detached volcanic eminences rising out of a wide area of subsidence, and doubtless as deriving their existence from the results of that subterranean movement.

These movements, without question, we must again trace back to consequences of the original heat of the earth. There are various ways in which the heat may have acted. Thus a considerable accession of heat expands rocks; and, on the other hand, a loss of heat causes them to contract. We may suppose, therefore, that, during the subterranean changes, a great extent of the crust underneath a tract of land may have its temperature slowly raised. The effect of this increment would be to cause a slow uprise of the ground above. The gradual transference of the heat to another quarter might produce a steady subsidence. Such variations in subterranean temperature, however, could give rise at the most to very insignificant elevations or depressions. A far more important and generally effective cause is to be sought in the secular contraction of the globe. If our planet has been steadily losing heat by radiation into space, it must have progressively diminished in volume. The cooling implies contraction. According to Mr. Mallet, the diameter of the earth is less by at least 189 m. since the time when the planet was a mass of liquid. But the contraction has not manifested itself uniformly over the whole surface of the planet. The crust varies much in structure, in thermal resistance, and in the position of its isogeo-thermal lines. As the hotter

nucleus contracts more rapidly by cooling than the cooled and hardened crust, the latter must sink down by its own weight, and in so doing must accommodate itself to a continually diminishing diameter. The descent of the crust gives rise to enormous tangential pressures. The rocks are crushed, crumpled, and broken in many places. Subsidence must have been the general rule, but every general subsidence would doubtless be accompanied with local upheavals of a more limited kind. The positions of these upheaved tracts would largely depend upon the original structure of the crust. The action would occur in lines which, once taken as lines of weakness or relief from the intense strain, would probably be used again and again at successive paroxysms or more tranquil periods of contraction. Mr. Mallet has ingeniously connected these movements with the linear direction of mountain chains, volcanic vents, and earthquake shocks.

Mountains may arise from three causes: 1, from the corrugation of the earth's crust due to the effects of secular contraction; 2, from accumulation of materials poured out of volcanic orifices; and, 3, from isolation of elevated masses of ground, owing to the removal, by denudation, of the materials originally connecting them, and to the consequent formation of valleys. Mountains formed in the volcanic way are almost always conical, and are either solitary, as Etna, or occur in linear groups, like the volcanoes of Java. Those formed by denudation are of minor dimensions, and deserve rather the name of hills. Mountain-chains, on the other hand, which are the dominant features of the earth's surface, though they may have lines of volcanic vents along their crests, are not formed essentially of volcanic materials, but of the sedimentary and crystalline rocks of the crust which have been ridged up into vast folds. If the continental lands may be compared to great undulations of the solid surface of the globe, the mountain-chains may be likened to the breaking crests of such wave-like movements. In their internal structure, mountain-chains bear witness to the intense crumbling of the rocks during the process of upheaval. As a consequence of the uprise of two or more parallel ranges of mountains, lines of longitudinal valleys must be produced. But no sooner is a mass of land raised above the sea than it is exposed to the attacks of air, rain, frost, springs, glaciers, or other meteoric agents of disintegration. Its surface is then worn down, the flow of water down its sides cuts out gulleys, ravines, and valleys, so that eventually a very rugged surface is produced, on which, probably, no portion of the original surface of upheaval may remain, but where new lines of minor ridge and valley may appear as the combined result of internal geological structure and atmospheric denudation. During the movements by which mountain masses have been upheaved, the stratified rocks have been so compressed as to occupy, in many cases, but a small proportion of the horizontal extent over which they originally extended. They have adjusted themselves to this diminished area by undergoing intense plication, and thus acquiring a much greater vertical depth. On the other hand, they have been abundantly fractured, some portions of their mass being pushed up, others being let down, so that the crust is traversed with a kind of complicated network of fissures.

The greater part of the geological changes are produced by agencies active at the earth's surface. These agents are material and visible, and we can see and feel their action. The movements of the air; evaporation from land and sea; rain, hail, and snow; the flow of rivers and glaciers; the tides, waves, and currents of the ocean; the growth and decay of organized existence on land and sea; the whole circle of movement now in progress must come into view. *Epigene* is suggested as a convenient term for this visible action, antithetical to *hypogene*, or subterranean action, already considered. A simple arrangement of this part of geological dynamics will be in three sections: 1. Air—the influence of the atmosphere in forming and destroying rocks; 2. Water—the geological functions of the action of the sea and of the circulation of water through the air, and between sea and land; 3. Life, or the part taken by plants and animals in preserving, destroying, and reproducing geological formations. The words destructive, reproductive, and conservative, employed in describing the operations of the epigene agents, do not necessarily imply that anything useful to man is destroyed, reproduced or preserved. On the contrary, the destructive action of the atmosphere may turn barren rock into rich soil, while its reproductive effects sometimes turn rich land into barren desert. Again, the conservative influence of vegetation has sometimes for centuries retained as barren morass what might otherwise have become rich meadow or luxuriant woodland. The terms are used in a strictly geological sense, to denote the removal and reproduction of material and its agency in preserving what lies beneath it.

The *Movements of the Air* are due to the differences in the pressure or density of the atmosphere, the law being that the air always moves from areas of high pressure to areas of low pressure. Atmospheric pressure is determined by temperature and aqueous vapor. Warm air rises, cold air falls. Horizontal currents flow from the cooler regions to replace the volumes which ascend in the warmer. To this cause the trade winds and the well-known land and sea breezes are due. As watery vapor increases, the density of the air is lessened. Moist air, like warm air, has a tendency to rise. The ascent of moist air lessens the atmospheric pressure, which is shown by a fall in the barometer. When vapor rises to the upper atmospheric regions it expands, cools, condenses, and descends in rain. Unequal and rapid heating of the air, and the accumulation of aqueous vapor, and perhaps some influences not understood, create great disturbances in pressure, resulting in storms, hurricanes, and cyclones. The fall of a tenth of an inch in an hour

in the barometer is usually followed by violent storms. When atmospheric pressures are widely different in neighboring localities the wind will move from the area of high to that of low pressure, and if the difference in pressure be great, a fierce storm is likely to occur. The average pressure of the air in motion is rated as follows: In a calm, no movement, no pressure; light breeze, 14 m. an hour, 1 lb. to the sq. foot; strong breeze, 42 m. an hour, 9 lbs.; strong gale, 70 m. an hour, 25 lbs.; hurricane, 84 m. an hour, 36 lbs. The changes produced by the air are both chemical and mechanical, and often inseparably united. If chemical, they appear in oxidation (rust) of metals, in the absorbtion of carbonic acid by rocks, and the production of earthy carbonates and bicarbonates, which promote the process of decomposition. Dry air has little oxidizing power; moisture is needed for the process. Every housewife knows that iron forks will long remain free from rust if kept from moisture. In towns the air takes up sulphuric and nitric acid to such an extent as to corrode metal surfaces as well as the mortar of walls, which may often be seen to swell out and drop off, owing to the conversion of its lime into sulphate.

Expansion and contraction are produced in rocks, as in other substances, by heat and cold. In regions where the range of temperature is great, there is much difficulty in finding building materials that will not be seriously affected by such changes. An engineer of the United States army some time ago investigated the expansion of certain materials. He found that in fine grained granite the rate for every degree of Fahrenheit was .000004825; for crystalline marble, .000005668; and in red sandstone, .000009532, or about twice as much as in granite.

Freezing Water expands and exerts an enormous strain upon any inclosed cavities or walls which contain it. In severe cold, trees often burst from the expansion of frozen sap. The winds, by driving loose sand over rocks, give them a smoother surface. Prof. Dana asserts that at Cape Cod holes have been drilled in window glass by drifting sand. Cavities are sometimes hollowed in rocks by gyrating sand and fragments of stone. Hurricanes are geological agents, inasmuch as they tear down trees and sometimes impede the drainage of a country and give rise to peat morasses. The term "weathering" includes all the superficial changes which rocks undergo in consequence of atmospheric action. Everywhere disintegration is going on more or less rapidly.

Of all the terrestrial agents by which the surface of the earth is geologically modified, by far the most important is *water*. This substance exists in three forms; 1, vapor, invisible; 2, liquid, or water; 3, solid, as ice. By the sun's heat vast quantities of vapor are continually raised from the surface of the seas, rivers, lakes, snow-fields, and glaciers of the world. This vapor remains invisible until the air containing it is cooled down to below its dew-point, or point of saturation. At first, minute particles appear, which either remain in the liquid condition, or, if the temperature be sufficiently low, are frozen into ice. As these changes spread over a considerable area of sky they give rise to the phenomena of clouds. Further condensation augments the size of the cloud-particles, and at last they fall to the earth, if liquid, as rain, if solid, as snow or hail. On the higher elevations they fall in snow, and form glaciers, which send down their drainage to the valleys and plains. Much of the rain sinks into the ground to gush out again in springs, while the remainder pours down the slopes of the land, feeding brooks and torrents, which, swollen further by the springs, unite in rivers through which the drainage of the land is carried to the sea. From the sea the vapor again rises, to re-appear in clouds and showers and to feed the streams of the land. Here is a vast system of circulation in perpetual renewal. And in all the system there is not a drop of water which is not busy with its allotted task of changing the face of the earth. When the vapor ascends into the air it is almost chemically pure. But when, after being condensed into visible form, and working its way over or under the surface of the land, it once more enters the sea, it is no longer pure, but more or less loaded with material taken by it out of the air, rocks, or soils through which it has traveled. Day by day the process is advancing. So far as we know it has never ceased since the first shower fell upon the earth. We may well believe, therefore, that it must have worked marvels upon the surface of the planet in past time, and that it may effect vast transformations in the future.

Under the head of TERRESTRIAL WATERS, we must consider rain, underground water, brooks, rivers, lakes, frost, river ice, snow, hail, and glaciers. Rain produces two changes on the surface: it acts chemically on soils and stones, and sinking into the ground, continues a series of similar reactions there. It also acts mechanically by washing away loose materials, and thus powerfully affecting the contours of the land. Rain contains carbonic acid absorbed from the air, and some other ingredients, in addition to its natural hydrogen and oxygen. Rain water contains on the average 2½ per ct. of gas which is composed of 66.4 nitrogen, 31.2 oxygen, and 2.4 carbonic acid. Common salt, ammonia, sulphates, nitric acid, inorganic dust, and organic matter are usually present in minute quantities in rain water. The ingredients chiefly effective in chemical reactions are oxygen, carbonic acid, and organic matter. The effect of water upon rocks and other solid matter scarcely needs explanation. It is always more or less in the direction of decomposition. There is probably no known substance which is not, under some condition, soluble in water containing carbonic acid or other natural

re-agents. As rain is so universally distributed over the globe, this chemical action must be of very general occurrence. The usual results of the fall of rain upon a land surface must be a disintegration and consequent lowering of that surface. To form a true conception of this action we need to watch what takes place over a wide region. The whole land surface over which rain falls is exposed to waste. The superficial covering of decayed rock or soil is constantly, though slowly, traveling downward to the sea. In this ceaseless transport rain acts as the great common carrier. The particles of rock loosened by the atmospheric waste, by frost, or by the chemical action of the rain itself, are washed off to form a new soil. But they, as well as the particles of the soil, are, step by step, moved downward over the face of the land till they reach the nearest brook or river, whence their seaward progress may be rapid. A heavy rain discolors the water-courses of a country, because it loads them with the fine débris which it removes from the general surface of the land. In this way rain serves as the means whereby the work of the other disintegrating forces is made conducive to the general degradation of the land. The decomposed crust produced by weathering, which would otherwise accumulate over the solid rock and protect it from further decay, is removed by rain so as to expose a fresh surface to further decomposition. This decay is general and constant, but not uniform. In some places, from the nature of the rock, from the flatness of the ground, or from other causes, rain works under great difficulties. There the rate of waste must consequently be extremely slow. In other places, again, the rate may be rapid enough to be appreciable from year to year. A survey of this department of geological activity shows how the unequal wasting by rain has helped to produce the details of the present condition of the land; those tracts where the destruction has been greatest, forming hollows and valleys, others, where it has been less, rising into ridges and hills. Rain-action is not always merely destructive. Usually it is accompanied by reproductive effects, and, as already remarked, the moldered rock which it washes off furnishes materials for the formation of soil. In favorable situations it has gathered together accumulations of loam and earth from neighboring higher ground—the "brick-earth," "head," and "rain-wash" of the south of England—earthy deposits, sometimes full of angular stones, derived from the subaerial waste of neighboring rocks.

The phenomena of *Hypogenic Action* must be accompanied with very considerable changes in the rocks which form the earth's outer crust. The importance of heat in tho transformations of rocks is fully admitted. Two sources of subterranean heat have had their agency in the production of hypogenic changes: 1, the internal heat of the globe; 2, the heat due to the transformation of mechanical energy in the crumbling, fracturing, and crushing of the rocks of the crust as these have been from time to time compelled to adjust themselves to the diminishing diameter of the more rapidly cooling and contracting interior. In pursuing the investigation we have to consider the temperature, from the lowest at which any change is possible up to that of complete fusion; the nature of the rock operated upon, some materials being much more susceptible to change from heat than others; the pressure under which the heat acts, the potency of this agency being much increased with increase of pressure; the presence of water, whereby chemical changes take place which would not be possible in dry heat. It may be concluded that the manner in which rocks have been melted within the crust is not that more simple fusion which we can accomplish artificially, but that it has involved conditions which have not been successfully imitated in any laboratory or furnace. It may be considered that while some rocks, like obsidian or pitchstone, which so closely resemble artificial glasses, may have been derived from a simple igneous fusion, such as can be imitated in a furnace, the great majority of rocks have had a more complex origin, and in a great number of cases can be proved to have been mingled with more or less water, while they were still fluid. In the second place, there can be no question that, in the great hypogenic laboratory of nature, rocks have been softened and fused under enormous pressure. In one instance such pressure has been calculated to equal that of an overhanging mass of rock 50,000 ft. high.

The process called sublimation, by which mineral substances can be obtained in a crystallized form from the condensation of vapors, may be the result of the mere cooling and reappearance of bodies which have been vaporized by heat and afterward solidified by cooling, or, from the solution of these bodies in other vapors or gases, or from the reaction of different vapors upon each other. These operations frequently occur at volcanic vents and in the crevices of recently erupted and still hot lava streams. They have been successfully imitated by experiments. Superheated steam is endowed with a remarkable power of dissolving that intractable substance, silica; artificially heated to the temperature of the melting point of cast-iron, it rapidly attacks silica, and deposits the mineral in snow-white crystals as it cools. Besides the influence of pressure in raising the melting point of subterranean rocks, and in permitting water to remain fluid among them at temperatures far above the boiling point, even at a red, or perhaps, a white heat, we have to consider the effect produced by the same agent upon rocks already solidified. The simplest and most obvious result of pressure upon such rocks is their consolidation, as where a mass of loose sand is gradually compacted into a more or less coherent stone, or where a layer of vegetation is compressed into peat, lignite, or coal. If pressure becomes extremely unequal, or if the rock can escape from

the influence in one or more directions, there will be a disturbance or rearrangement of the particles which are by this means made to move upon each other. These disturbances are: 1, cleavage, from strong lateral pressure; 2, pebbles and organic remains squeezed into each other; 3, the formation of jets of metal or rock material by some great pressure; 4, compression, or plication, produced by the cooling and shrinking of the earth, as shown in contracted rocks; 5, faults or dislocations resulting from elevation or upheaval.

While subterranean heat has had a large part in the construction of the materials of the earth's crust, water, on the other hand, has performed a hardly less important share of the task. Fire and water have often co-operated in such a way that the result must be taken as their joint achievement; but we are now to consider the changes produced by water, pure or otherwise, and at ordinary or other temperatures. All rocks at or near the earth's surface contain water, not chemically in combination, but in their pores. Most of it evaporates when the stone is freely exposed to the air. Rocks differ in water-absorbing capacity. Gypsum will take from one-half to one and one-half per ct. by weight; granite a third of one per ct.; quartz scarcely anything; chalk 20 per ct. All surface rocks contain water, and no mineral substance is strictly impervious to the passage of liquid. It is now well understood that there is probably no terrestrial substance which, under proper conditions, is not to some extent soluble in water. The mere presence of pure water within the pores of subterranean rocks must change their composition. Some of the more soluble materials must be dissolved, and as the water evaporates, must be deposited in a new form. But water in a natural state is never chemically pure. In its descent through the air it absorbs oxygen and carbonic acid, besides other impurities, and as it filters through the soil it abstracts more carbonic acid, as well as other results of decomposing organic matter: thence it effects numerous decompositions of the rocks underneath. The nature of these changes may be inferred from the composition of spring water. Two important kinds of chemical decomposition must evidently arise from the action of such infiltrating water. 1. The presence of the organic matter must exercise a reducing power on oxides. This will be more especially the case with those of iron, the nearly insoluble hæmatite being reduced to the protoxide, which, converted into carbonate, is readily removable in solution. There can be little doubt that by this means a vast amount of ferruginous matter is extracted from subterranean rocks and carried to the surface. 2. The presence of carbonic acid enables the water to attack vigorously the mineral constituents of rocks. Alkaline carbonates, with carbonates of lime and magnesia, and protoxides of iron and manganese, are produced, and these substances borne onward in solution give rise to further reactions among the rocks through which they are carried. "In the decomposition of rocks," says Bischof, "carbonic acid, bicarbonate of lime, and alkaline carbonates bring about most of the decompositions and changes in the mineral kingdom." The microscopic study of rocks has thrown much light upon the mineralogical alterations in rocks due to the influence of percolating water. Even the most solid-looking, unweathered rocks, are found to have been affected by such metamorphism. Their hydrous magnesian silicates, for example, are partially or wholly converted into such hydrous forms as serpentine, chlorite or delessite. The process of conversion may often be watched. It can be seen to have advanced along the fissures or cleavage-planes of the minerals, leaving the intervening sections still fresh; or it may be observed to have proceeded in such a way that diffused alteration-products are dispersed in filaments or irregular patches through the base of the rock, or gathered together and even recrystallized in cavities; or the whole rock, as in many serpentines, has undergone an entire transformation. Much information regarding such internal alterations of rocks may be obtained from the study of *pseudomorphs*, that is, crystals having the external form of the mineral of which they originally consisted, with the internal structure and composition of the mineral which has replaced it. Serpentine representing olivine, clay taking the place of rock-salt, silica that of wood, and marcasite that of molluscan shells, are familiar examples. There is no reason to doubt that these changes may, in the course of ages, have been effected at ordinary temperature by water descending from the surface of the ground. But two other considerations require to be taken into account in the discussion of the internal transformations of rocks by subterranean water. 1. The water has often been at a high temperature. Mere descent into the crust of the earth will raise the temperature of the water until, if this descent be prolonged, a point far above 212° Fahr. may be reached. Experiments have shown that the chemical action of water is vastly increased by heat. Thus M. Daubrée exposed a glass tube containing about half its weight of water to a temperature of about 400° centigrade. At the end of a week he found the tube so entirely changed into a white, opaque, powdery mass as to present not the least resemblance to glass. The remaining water was highly charged with an alkaline silicate containing 63 per ct. of soda and 37 per ct. of silica, with traces of potash and lime. The white solid substance was ascertained to be composed almost entirely of crystalline materials. These consisted partly of minute, perfect, limpid bipyramidal crystals of quartz, but chiefly of very small acicular prisms of wollastonite. It was found, moreover, that the portion of the tube which had not been directly in contact with the water was as much altered as the rest, whence it was inferred that at these high temperatures and pressures the vapor of water acts

chemically like the water itself. 2. The effect of pressure must be recognized as most important in enabling water, especially when heated, to dissolve and retain in solution a larger quantity of mineral matter than it otherwise could do. In M. Daubrée's experiments just cited, the tubes were hermetically sealed and secured against fracture, so that the pressure of the greatly superheated vapor had full effect. By this means, with alkaline water, he not only produced the two minerals above mentioned, but also feldspar and diopside. It is important to observe that the three conditions required for these changes—the presence of alkaline water, a high temperature, and considerable pressure—are precisely those which can be affirmed to exist abundantly within the crust of the earth. We must admit that rocks originally at the surface may have been so depressed as to come within the influence of internal heat, and may contain within their pores abundant interstitial water more or less charged with alkaline carbonates. Rocks under these conditions, so far as we can judge, can hardly escape internal decomposition and recomposition. Mere descent to a great depth beneath the surface will not necessarily result in metamorphism, as has been shown in the Nova Scotian and South Welsh coal-fields, where sandstones, shales, clays, and coal-seams can be proved to have once been depressed 14,000 to 17,000 ft. below the sea-level, under an overlying mass of rock, and yet to have sustained no serious alteration. Perhaps the failure of change may be explicable on the supposition that these carboniferous strata were comparatively dry. But where rocks possess sufficient interstitial water, and are depressed within the crust so as to be exposed to a considerable temperature and to great pressure, they must be metamorphosed—the extent of the metamorphism depending partly upon the vigor of the attack made upon them by the water, partly on their own composition and proneness to chemical change, and partly upon the length of time during which the process was continued. A metamorphosed rock must thus be one which has suffered a mineralogical rearrangement of its substance. It may or may not have been a crystalline rock originally. Any rock capable of alteration (and all rocks must be so in some degree) will, when subjected to the required conditions, become a metamorphic rock. The resulting structure, however, will, in some cases, bear witness to the original character of the mass. A sedimentary rock, for example, consisting of alternate layers of different texture and composition will doubtless retain, even in its metamorphosed condition, traces of that fundamental structure. The water will travel more easily along certain layers than along others; some laminæ will be more readily affected, or will give rise to a set of reactions different from those of contiguous layers. Hence the rearrangement and recrystallization due to metamorphism will take place along the predetermined lines of stratification, so long as these lines have not been effaced or rendered inoperative by any other geological structure. It is doubtless to this cause that the foliated character of gneiss, mica-schist, and so many other metamorphic rocks is to be ascribed. In the process of metamorphism, therefore, as well as in that of fusion, to which reference has already been made, the influence of water would seem to have been always conspicuous. Indeed, it is extremely difficult in many cases to draw a line between the results of metamorphism and igneous fusion, or to decide whether a rock should be called igneous or metamorphic. It has been pointed out, for example, that in many rocks which have undoubtedly been in a fluid condition, as proved by their injected veins and dikes, the constituent minerals have not appeared in the form of their respective fusibilities. Scheerer, Élie de Beaumont, and Daubrée have shown how the presence of a comparatively small quantity of water in such rocks has contributed to suspend their solidification, and to promote the crystallization of their silicates at temperatures considerably below the point of fusion. In this way the solidification of quartz in granite after the crystallization of the silicates, unintelligible on the supposition of mere dry fusion, becomes explicable.

It scarcely needs to be stated that there is underground water almost everywhere, and that everywhere it is producing effects similar to those produced by surface water. That water really circulates underground, and passes not merely between the rocks, but in crevices and tunnels which it has no doubt to a large extent opened for itself along natural joints and fissures, is proved by the occasional rise of leaves, twigs, and live fish in the shafts of artesian wells. These facts prove that the water travels leagues and leagues under the surface of the earth. The temperature of underground springs is an indication of the depth from which they rise. Very cold springs probably derive their water from glaciers or snow-covered summits. The hottest springs are found in volcanic districts, but there are warm springs far away from such districts. Assuming a rise of one degree of heat for each 60 ft. in depth, the source of a spring whose temperature is 120° would be 4,200 ft. below the surface, and water at the boiling point should rise nearly 13,000 feet. The underground circulation of water has great interest for the geologist, from the light which it affords as to the changes that rocks undergo, and the manner in which these changes are effected. As in the case of rain, underground water acts both chemically and mechanically. Leaving processes and coming directly to results we find, since every spring is busily engaged in bringing mineral substances from below ground to the surface, that there must evidently be a vast amount of subterranean waste, and many tunnels, channels, and caverns must, in consequence, be formed. To take one illustration: the warm springs of Bath, with a mean temperature of 120° Fahr., are impregnated with sulphates of lime and soda, and chlorides of

sodium and magnesium. Prof. Ramsay has estimated their annual discharge of mineral matter to be equal to a square column 9 ft. in diameter and 140 ft. in height. It is in calcareous regions that the extent of the subterranean loss can be most strikingly seen. Sometimes a district of limestone is drilled with vertical cavities ("swallow holes" or "sinks") formed by the solution of the rock by the descent of carbonated rain-water. Surface-drainage is there intercepted, and passes at once underground, where, in course of time, an elaborate system of channels may be dissolved out of the solid rock. Such has been the origin of the Peak caverns of Derbyshire, the intricate grottoes of Antiparos and Adelsberg, and the vast labyrinths of the Mammoth cave of Kentucky. In the course of time the underground rivers open out new courses, and leave their old ones dry. By the falling in of the roofs of caverns near the surface, brooks and rivers are occasionally engulfed, which, after a long subterranean course, may issue to the surface again in a totally different surface area of drainage to that in which they took their rise, and sometimes, as in Florida, with volume enough to be navigable almost up to their outflow. In such circumstances lakes may be formed over the broken-in caverns; and valleys may thus be deepened, or perhaps even formed. Mud, sand, and gravel, with the remains of plants and animals, are swept below ground, and sometimes accumulate in deposits there. This has been the origin of ossiferous caverns, and of the loam and breccia so often found in them. These wonderful results of the subterranean circulation of water appeal to the imagination, and are those usually most dwelt upon as evincing the potency of this kind of geological agency. And yet the thoughtful observer who reflects upon this subject, will perhaps be led to perceive that even more important than these visible caverns and grottoes are the silent unobtrusive changes so constantly in progress in the solid heart of the rocks. As far down as percolating water reaches there is not a particle of mineral matter safe from its attacks. And, as we have seen, it is hardly possible to find any rock which does not bear throughout its minute grains and pores evidence that water has filtered through it, removing some substances and putting others in their place. In its passage along fissures and channels of the rocks, the underground water not merely dissolves materials chemically and removes them in solution, it likewise loosens some of the finer particles from the sides of these subterranean conduits and carries them along in mechanical suspension. We may occasionally observe, where a spring gushes forth at the surface, that grains of sand are brought up in the clear sparkling water. This removal of material sometimes produces remarkable surface changes when it takes place along the side of a steep slope or cliff, such as those which occur in river valleys, or by the sea-coast. Let us suppose a thin layer of some porous material, like loose sand or ill-compacted sandstone, to lie between two more impervious rocks, such as masses of clay or limestone, and that this porous stratum sloping down from higher ground comes out to the surface near the base of a line of abrupt cliff. The water which finds its way down into this layer will use it as its channel of escape, and traveling along its course will issue in springs or in a more general oozing forth along its outcrop at the foot of the declivity. Under these circumstances, the support of the overlying mass of rock is apt to be loosened. The water not only removes piecemeal the sandy layer on which that overlying mass rests, but, as it were, lubricates the rock beneath. Consequently at intervals, portions of the upper rock may break off and slide down into the valley or plain below. Such dislocations are known as *landslips*. Many illustrative examples might be cited. Thus, in the year 1839 a mass of chalk on the Devonshire coast slipped over a bed of clay into the sea, leaving a rent three-quarters of a mile long, 150 ft. deep, and 240 ft. wide. The shifted mass, bearing with it houses, roads, fields, was cracked, broken, and tilted in various directions, and was thus prepared for further attack and removal by the waves. On many parts of the coasts of Britain there are landslips on a large scale which doubtless took place many centuries ago, or even, in some cases, beyond the times of human history. The undercliff of the isle of Wight, the cliffs w. of Brandon Head, county Kerry, the basalt escarpments of Antrim, and the edges of the great volcanic plateaus of Mull, Skye, and Rasay, furnish illustrations of such prehistoric landslips. Of continental examples, the well known fall of the Rossberg, behind the Righi in Switzerland, is one of the most memorable. After a rainy summer in 1806, a large part of one side of the mountain, consisting of sloping beds of hard red sandstone and conglomerate, resting upon soft sandy layers, gave way. Thousands of tons of solid rock suddenly swept across the valley of Goldau, burying four villages, with about 500 of their inhabitants. In 1855, a mass of debris, 3,500 ft. long, 1000 ft. wide, and 600 ft. high, slid into the valley of the Tiber, which, dammed back by the obstruction, overflowed the village of San Stefano to a depth of 50 ft., until drained off by a tunnel.

The surface drainage of the globe is through brooks and rivers, which carry to lakes and seas, not only the surplus surface-water, but immense quantities of material torn from the land. Like all other moving water, streams have both a chemical and a mechanical action. The substances held in solution in river-water include carbonates of lime, magnesia, and soda; silicates, peroxides of iron and manganese; sulphates of lime, magnesia, potash, and soda; chlorides of sodium, potassium, calcium, and magnesium; silicate of potash; nitrates, and organic matter. As an average, there are 21 parts of mineral matter in 100,000 of water, and carbonate of lime makes up one-half

of all the solid matter. It has been calculated that the Rhine carries annually to the sea enough carbonate of lime to make 332,000,000,000 of oyster-shells of ordinary size. Sulphate of lime is the next most abundant mineral. An English scientist estimates that there may be every year dissolved by rain one hundred tons of rocky matter to each square mile of the earth's surface. The mechanical action of running streams needs no explanation. The enormous deposits made near the mouths of great rivers, and the constant effort to preserve channels and harbors, are always before us. The deltas of the Nile and the Mississippi are instances of the enormous transporting power of rivers. Three thousand miles from the gulf of Mexico the Missouri river starts a yellow stream of mud, gathering more and more as it goes on, and with the added volume of the Mississippi, the Ohio, and other streams, bears its mud to the gulf.

In Africa, Livingstone found rivers whose composition seemed to be more of sand than of water. The power of running water for abrasion or wearing away is well illustrated in the case of the falls of Niagara, where the stream may have fallen over the Queenstown cliff when the river first sought its way to the sea. But much more probably the escarpment and waterfall began to arise simultaneously and from the same geological structure. As the escarpment grew in height, it receded from its starting-point. The river ravine likewise crept backward, but at a more rapid rate, and the result has been that at present the cliff, worn down by atmospheric causes, stands at Queenstown, while the ravine extends 7 m. further inland, with a width of from 200 to 400 yards, and a depth of from 200 to 300 feet. In this, as in other cases, the waterfall has cut its way backward up the course of its stream, and will continue to do so as long as the structure of the gorge continues as it is now—a thick bed or beds of limestone resting horizontally upon soft shales. The softer strata at the base are undermined, and slice after slice is cut off from the cliff over which the cataract pours. It has been estimated that, at their present rate of recession, the Niagara falls must have taken about 35.000 years to cut their way backward, and excavate the gorge between their present position and Queenstown. In other cases, waterfalls have been produced by the existence of a harder and more resisting band or barrier of rock crossing the course of the stream, as, for instance, where the rocks have been cut by an intrusive dike or mass of basalt. In these and all other cases, the removal of the harder mass destroys the waterfall, which, after passing into a series of rapids, is finally lost in the general abrasion of the river-channel. The most marvelous river gorges in the world are those of the Colorado region in North America. The rivers there flow in ravines thousands of feet deep and hundreds of miles long, through vast table-lands of nearly horizontal strata. The Grand Canyon (ravine) of the Colorado river is 300 miles long, and in some places more than 6,000 feet in perpendicular depth. The country is hardly to be crossed, except by birds, so profoundly has it been trenched by these numerous gorges. Yet the whole of this excavation has been effected by the erosive action of the streams themselves.

Lakes are fresh or salt; those having outlets are usually fresh; those having none are usually salt. The geological functions of lakes are: 1. To arrest and equalize drainage by regulating the outflow and preventing or lessening the destructive effects of floods; 2. To filter river water and permit the undisturbed accumulation of new deposits, which, in some modern cases, may cover thousands of square miles of surface; 3. To furnish an abode for a lacustrine fauna and flora, to receive the remains of the plants and animals washed down from the surrounding country, and to entomb all those organisms in the growing deposits so as to preserve a record of the terrestrial life of the period. Salt lakes are of two classes: 1. Those which owe their saltness to the evaporation and concentration of the fresh water poured into them by their feeders; 2. Those which were originally parts of the ocean. Of the first order are Great Salt lake in Utah, and many smaller ones. They were doubtless fresh at first, but ages of evaporation have condensed the salt and made them what they are. The Caspian sea is the most conspicuous specimen of the second class. This was no doubt a part of the Black sea and the Mediterranean, as the formation of the surrounding country shows. The surface of the Caspian is now more than 80 ft. below that of the Black sea. Along the shallow pools which border the Caspian a constant deposition of salt is taking place, sometimes forming a layer of rose-colored crystals on the bottom, or gradually becoming dry and covered with drift-sand. This concentration of the water is still more marked in the great bay called the Karaboghaz, which is connected with the middle basin of the Caspian by a channel 150 yards wide and 5 ft. deep. Through this narrow mouth there flows from the main sea a constant current which Von Baer estimated to carry daily into the Karaboghaz 350,000 tons of salt.

In the form of *ice*, water performs important geological operations, in the five conditions of frost in general, frozen lakes and rivers, hail, snow, and glaciers. It is well known that water expands in freezing. At 30° Fahr. the pressure is 146 atmospheres, or the weight of a column of ice a mile high, which is equal to 276,000 lbs. per sq. foot. Cannons and bombshells filled with water have been burst by the expansion of ice. Such an agency must be of great geological importance. Soils and rocks are pushed asunder by the expanding ice, and their cohesion is loosened or destroyed so that when a thaw comes they seem as if they had been ground down in a mortar. In Spitzbergen and on the coast of Greenland the amount of destruction caused by frost is enormous. The short and warm summer, rapidly melting the snow, fills the pores and joints of the

rocks with water, which, when it freezes, splits off large blocks of rock from the hills and sends them down to the valleys, where they are further broken up by similar causes. At the breaking up of ice in the spring many transformations are made. Large rocks are carried from shores, and sometimes from the hollows, to remote points; shores are abraded or heaped with new material, and in many cases disastrous overflows are the result. Hail is infrequent and its consequences are not important. Now and then the pellets are large enough to strip trees of their leaves, and even to kill animals and cattle, but such results are exceptional. Snow is a more important factor in meteorology or geology. There is a snow-line or elevation at which snow is perpetual over all the earth, varying from 19,000 ft. above sea-level, in the region of the Himalayas, to less than 3,000 ft. in the extreme north or south. Snow is both conservative and destructive. As a conservative force, it protects the soil from frost, and thereby protects crops and roots from freezing and winter-killing. On mountain slopes snow may create avalanches, which in their descent may be very destructive. (For GLACIERS, see *ante*.)

We come to the *ocean*, which, as a dynamical agent in geology, may be studied from two points:—1, its movements; 2, its geological work. Its movements are tides, currents, and waves. Tides are the oscillations caused by the attraction of the sun and the moon. In the Atlantic ocean the tidal movement is 600 miles an hour. In the open sea this movement is of little consequence, but when the tidal wave enters a narrow or shallow sea the rates of motion and of force are greatly increased, and it is in such places that tides acquire their geological importance. Tides vary in height from nothing to 70 feet. The most remarkable effect of this narrowing and compression is seen in the bay of Fundy, in Nova Scotia, where the flow from the sea raises the water to a height of 70 ft. or more. Other illustrations may be found on the w. coast of Scotland, and on the coast of Norway. In the Pentland firth the current runs 10 m. an hour. Recent researches in ocean temperature have disclosed the remarkable fact that beneath the surface-layer of water affected by the temperature of the latitude there lies a vast mass of cold water, the bottom temperature of every ocean in free communication with the poles being little above and sometimes actually below the freezing point of fresh water. In the north Atlantic a temperature of 40° Fahr. is reached at an average depth of about 800 fathoms, all beneath that depth being progressively colder. In the equatorial parts of the same ocean the same temperature comes to within 300 fathoms of the surface. In the South Atlantic, off the cape of Good Hope, the mass of cold water below 40° comes likewise to about 300 fathoms from the surface. This distribution of temperature proves that there must be a transference of solid polar water towards the equator, for in the first place the temperature of the great mass of the ocean is much less than that which is normal to each latitude, and in the second place, it is lower than that of the superficial parts of the earth's crust underneath. On the other hand, the movement of the water from the poles to the equator requires a return movement of compensation from the equator to the poles, and this must take place in the superficial strata of the ocean. Apart, therefore, from those rapid river-like streams which traverse the ocean, and to which the name of current is given, there must be a general drift of warm surface-water towards the poles. This is doubtless most noticeable in the north Atlantic, where, besides the current of the gulf stream, there is a prevalent set of the surface waters towards the n.e. As the distribution of life over the globe is everywhere so dependent upon temperature, it becomes of the highest interest to know that a truly arctic submarine climate exists everywhere in the deeper parts of the sea. With such uniformity of temperature we may anticipate that the abysmal fauna will be found to possess a corresponding sameness of character, and that arctic types may occur on the ocean-bed, even at the equator. But besides this general drift, or set, a leading part in oceanic circulation is taken by the more defined streams termed currents. The tidal wave becomes one of translation only as it passes into shallow water, and is thus of but local consequence. But a vast body of water, known as the equatorial current, moves in a general westerly direction round the globe. Owing to the way in which the continents cross its path, this current is subject to considerable deflexions. Thus that portion which crosses the Atlantic from the African side strikes against the coast of South America, and divides, one portion turning towards the s., and skirting the shores of Brazil, the other bending north-westward into the gulf of Mexico, and issuing thence as the well-known gulf-stream. This equatorial water is comparatively warm and light. At the same time the heavier and colder polar water moves towards the equator, sometimes in surface currents, like those which skirt the eastern and western shores of Greenland, but more generally as a cold under-current which creeps over the floor of the ocean as far as the equator.

Waves and ground-swell are other features of oceanic action. Sometimes these waves are disastrous, but commonly they are of little consequence. The sea is never still. There is always a great though scarcely perceptible swell; but when this swell nears the shore, the upper portion of water, traveling faster than the lower, rises into huge foam-crested billows or walls of water, which break with enormous force upon the beach. In the north of Scotland such billows often throw their spray to the height of 200 ft. It is estimated that a single roller of the ground-swell, 20 ft. high, falls with a pressure of about a ton on every square foot. The diminution of atmospheric pressure during a cyclone tends to raise the level of the sea within the cyclone's limits and

give rise to enormous waves. On Oct. 5, 1864, during a great cyclone which passed over Calcutta, the sea rose 24 ft., sweeping everything before it, and drowning 48,000 people.

Three chief types of sea-ice have been observed. In the arctic sounds and bays the littoral waters freeze along the shores and form a cake of ice which, upborne by the tide, and adhering to the land, is thickened by successive additions below, as well as by snow above, until it forms a shelf of ice 120 to 130 ft. broad, and 20 or 30 ft. thick. This shelf, known as the ice-foot, serves as a platform on which the abundant débris loosened by the severe frosts of an arctic winter gathers at the foot of the cliffs. It is more or less completely broken up in summer, but forms again with the early frosts of the ensuing autumn. The surface of the open sea likewise freezes over into a continuous sheet, which in summer breaks up into separate masses, sometimes of large extent. This is what navigators term "floe-ice," and the separate floating cakes are known as "floes." Ships fixed among these floes have been drifted with the ice for hundreds of miles, until at last liberated by its disruption. In the Baltic sea, off the coast of Labrador and elsewhere, ice has been observed to form on the sea-bottom. It is known as ground-ice, or anchor-ice. In the Labrador fishing-grounds it forms even at considerable depths. Seals caught in the lines of these depths are brought up sometimes solidly frozen. In the Arctic regions the vast glaciers which drain the snow-fields and descend to the sea, extend for some distance from the land, until large fragments break off and float away seawards. These detached masses are icebergs. Their shape and size vary greatly, but lofty peaked forms are common, and they sometimes rise from 200 to 300 ft. above the level of the sea. As only about a ninth part of the mass appears above water, those larger bergs may sometimes be from 2,000 to 3,000 ft. thick, from base to top. They consequently require water of some depth to float them, but they are often seen aground. In the antarctic regions, where one vast sheet of ice envelopes the land and extends as a high rampart into the sea, the detached icebergs often reach immense size, and are characterized by the frequency of a flat tabular form.

The *Influence of Climate* is one of the most important geological agencies. Ocean currents from warm regions raise the temperature of the places into which they flow: currents from cold regions lower it. The ocean is the great distributor of temperature over the earth. Note the opposite sides of the Atlantic. Along the North American coast runs the cold arctic current, greatly depressing what would be the normal temperature. On the coast of Europe the gulf stream pours the warm water of the tropics, and correspondingly heightens the temperature. Dublin and the s.e. point of Labrador are in the same latitude, yet the mean temperature of Labrador is 18° lower than that of the Irish capital.

Another great geological force is found in the works of erosion by the sea, which is accomplished in four ways: 1. the enormous force of the breakers, which suffices to tear off fragments of solid rock; 2. the alternate compression and expansion of air in the crevices of the rocks exposed to heavy breakers, which dislocate rocks even above the limits of wave action; 3. the hydraulic pressure of those portions of large waves which enter fissures and cavities, forcing asunder masses of rock; 4. the waves using loose materials to batter down the cliffs exposed to their attacks. The dislodgement of immense masses of loose materials especially from rocky cliffs, is too well known to need elucidation. All along the coasts of England, Scotland, and Norway the waves are gnawing down the rocky shores. Blocks of granite weighing 50 tons or more have been torn out and tossed about as though they were of wood. These assaults of the waves are remarkably aided by a curious action of the air. At the Eddystone lighthouse, a door which had been securely fastened against the surf without, was actually driven outward by a pressure from within, the strong bolts and hinges being broken. It must be inferred that the sudden sinking of a great mass of water created a partial vacuum and that the air inside the lighthouse forced itself out to restore the equilibrium. But the greatest amount of erosion accomplished by the sea is due, not to its own direct mechanical impetus, but to the blows dealt by the bowlders, gravel, or sand which it drives against the shores. This is a kind of perpetual artillery playing against the land, here and there making breaches. This incessant attack from the sea has worn from the rocks the wonderful caves of Staffa and others of similar character along the w. coasts of Ireland, Scotland, and the Shetland and Orkney islands. The general result of the erosive action of the sea on the land is the production of a submarine plain. As the sea advances by cutting slice after slice away from the coast, successive lines of beach pass under low-water mark. The whole of the littoral belt, as far down as wave action has influence, is continually being ground down by the moving detritus. If no change of level between sea and land should take place, the sea might conceivably eat its way slowly far into the land, and produce a gently sloping yet almost horizontal selvage of plain covered permanently by the waves. In such a submarine plain the influence of geological structure, and notably of the relative powers of resistance of different rocks would make itself conspicuous. The present promontories caused by the superior hardness of their component rocks would no doubt be represented by ridges on the sub-aqueous plateau, while the existing bays and creeks worn out of softer rocks would be marked by lines of valleys or hollows.

Living Organisms have much to do with geological changes. Plants and animals co-operate with inorganic agents in promoting the degradation of the land, and on the

other hand, they protect rocks from decay. Plants keep the surface of rocks moist, and promote mechanical and chemical dissolution. In their decay they produce acids which are potent in decomposing rocks and in disintegrating soils. Of the destructive influence of animal life numerous illustrations may be given. 1. The composition and arrangement of soil are affected. Worms are continually engaged in bringing up the lower portions of the soil to the surface, thus increasing its fertility and its capability of being washed away by rain. Burrowing animals, by throwing up the soil and subsoil, expose these to be dried and blown away by the wind. At the same time their subterranean passages serve to drain off the superficial water and to injure the stability of the surface of the ground above them. In Britain, the mole and rabbit are familiar examples. In North America the prairie dog and the gopher have driven excavations under extensive tracts of pasture land in the west. In Cape Colony wide areas of open country seem to be in a constant state of eruption from the burrowing operations of multitudes of *Bathyergi* and *Chrysochloris*—small mole-like animals which bring up the soil and bury the grassy vegetation under it. 2. The flow of streams is sometimes interfered with, or even diverted, by the operations of animals. Thus the beaver, by constructing dams, checks the current of water-courses, intercepts floating materials, and sometimes even diverts the water into new channels. This action is typically displayed in Canada, and other parts of North America. The embankments of the Mississippi are sometimes weakened to such an extent by the burrowing of the cray-fish, as to give way, and allow the river to inundate the surrounding country. Similar results have happened in Europe from the subterranean operations of rats. 3. Some mollusca bore into stone or wood, and by the number of contiguous perforations, greatly weaken the material. Pieces of drift-wood are soon riddled with long holes by the teredo, while wooden piers, and the bottoms of wooden ships are often rapidly perforated. The saxicavous shells, by piercing rocks and opening cavities for rain and sea-water to fill, promote the decay of the stone. 4. Many animals exercise a ruinously destructive influence upon vegetation. Of the many insect plagues of that kind it will be enough to mention the locust, phylloxera, and Colorado beetle. The pasture in some parts of the s. of Scotland has in recent years been much damaged by mice, which have increased in numbers owing to the indiscriminate shooting and trapping of owls, hawks, and other predaceous creatures. Grasshoppers cause the destruction of vegetation in some parts of Wyoming and other western territories of the United States. The way in which animals destroy each other, often on a great scale, may likewise be included among the geological operations now under description.

Against these forms of destruction may be placed forms of conservative or reproductive action, shown chiefly in *Vegetation*. The slightest vegetation, to some extent, protects the surface from erosion, gives it solidity, and induces further vegetation. Vast sandy tracts have been to some extent redeemed by the judicious planting of trees that broke the force of the wind. In a similar way marine plants protect rocks along the shores. In mountain districts pine forests exercise an important influence in preventing the formation or arresting the progress of avalanches. Both plants and animals contribute materials towards new geological formations. Their remains are inclosed in deposits of sand and mud and there preserved. But they form of themselves not unimportant accumulations. Of plant formations the following illustrative examples may be given. 1. Peat-mosses are accumulations of marshy vegetation which occur in temperate and arctic latitudes, sometimes to a depth of 40 ft. or more. In Europe they have been largely formed by plants of the genus *Sphagnum*, which, growing as a spongy fibrous mass over wet ground, die in their lower parts and send out new fibers above. It is this lower decaying stratum which forms the peat. Every stage of the process may be seen in a large moss; from the green living plants at the top, through fibrous brown turf full of the scarcely decayed rootlets of the *Sphagnum* down to the compact brown or almost black peat at the bottom. Many peat-mosses were at one time lakes which have been gradually filled up by the accumulation of marsh plants. Peat possesses a great antiseptic power; the bodies of animals which have been entombed in it are sometimes preserved for many centuries. 2. Mangrove swamps are found on the low moist shores and river mouths of tropical countries, and the mangrove tree plays an important geological part. It grows in such situations in a dense jungle, sometimes 20 m. broad, which fringes the coast as a green selvage, and runs up or quite occupies creeks and inlets. The mangrove flourishes in sea-water even down to low-water mark, forming there a dense thicket which, as the trees drop their radicles and take root, grows outward into the sea. It is singular to find terrestrial birds nestling in the branches above, and crabs and barnacles living among the roots below. By this network of subaqueous radicles and roots the water is filtered of its sediment, which, retained among the vegetation, helps to turn the spongy jungle into a firm soil. On the coast of Florida the mangrove swamps stretch for a long distance as a belt from 5 to 20 m. broad, which winds round the creeks and inlets. At Bermuda the mangroves co-operate with the grasses and other plants to choke up the creeks and brackish lakes. In these waters calcareous algæ abound, and as their remains are thrown up amidst the sand and vegetation they form a remarkably calcareous soil. 3. *Diatom, mud or earth*, the minute siliceous plants called diatoms occur both in fresh and salt water, deposit their congregated remains both on the site of lakes and on the sea-floor. "Infusorial" earth and "tripoli powder" consist mainly of the fragmentary débris of diatoms which have

accumulated on the bottoms of lacustrine areas. Towards the antarctic circle the "Challenger" met with *diatomaceæ* in abundance, both in the surface waters of the ocean and on the bottom. At depths of from 1260 to 1975 fathoms they form a pale straw-colored deposit, which when dried is white and very light. Animal formations are chiefly composed of the remains of the lower grades of the animal kingdom, especially of *mallusca*, *actinozoa*, and *forminifera*. 1. In some cases they are calcareous. Lime, chiefly in the form of carbonate, is the mineral substance of which the solid parts of animals are mainly built up. Hence the great majority of accumulations formed of animal remains are calcareous. In fresh water they are represented by the marl of lakes—a white, chalky deposit of the moldering remains of *Mollusca*, *Entomostraca*, and partly of fresh-water *Algæ*. On the sea-bottom in shallow water they consist of beds of shells, such as the oyster-banks of English seas. The fringing barriers found at all coral-reefs of warm seas are conspicuous examples of wide and thick masses of rock formed from the accumulated growth of animal organisms. The great reef of Australia, for example, is 1250 m. long, from 10 to 90 broad, and more than 1800 ft. thick. The coral rock, though formed by the continuous growth of the polyps, gradually loses any distinct organic structure, and acquires an internal crystalline character owing to the infiltration of water through its mass, whereby carbonate of lime is carried down and deposited in the pores and crevices as in a growing stalactite. Great quantities of calcareous mud are produced by the breakers which beat upon the outer edge of the reefs. This mud is partly washed up on the reefs and aids in their consolidation, but in great measure is swept away by the ocean currents and distributed over many thousands of square m. of the sea-floor. In deep water over the bed of the Atlantic and many other oceans a remarkable calcareous ooze occurs which is formed of the remains of *Foraminifera*, and chiefly of species of the genus *Globigerina*. It is next in abundance to the red and gray clays of the deep sea. It is a pale-gray marl, sometimes red from peroxide of iron, or brown from peroxide of manganese; and it usually contains more or less clay, even with occasional fragments of pumice. 2. Siliceous deposits formed from animal exuviæ are illustrated by another of the deep sea formations brought to light by the "Challenger" researches. In certain regions of the western and middle Pacific ocean, the bottom was found to be covered with an ooze consisting almost entirely of *Radiolaria*. These minute organisms occur, indeed, more or less abundantly in almost all deep oceanic deposits. From the deepest sounding yet taken (4,575 fathoms, or more than 5 miles) a radiolarian ooze was obtained. The spicules of sponges likewise furnish materials towards these silicious accumulations. 3. Phosphatic deposits, in the great majority of cases, betoken some of the vertebrate animals, seeing that phosphate of lime enters largely into the composition of their bones, and occurs in their excrement. The most typical modern accumulations of this nature are the guano beds of rainless islands off the western coast of South America, and Southern Africa. In these regions immense flocks of sea-fowl have, in the course of centuries, covered the ground with an accumulation of their droppings to a depth of, in some places, 30 to 80 feet, or even more. This deposit, consisting chiefly of organic matter and ammoniacal salts with about 20 per ct. of phosphate of lime, has acquired a high value as a manure, and is being rapidly cleared off. It could have been preserved only in a rainless or almost rainless climate. On the west of Europe isolated stacks and rocky islands in the sea are often seen to be white from the dropping of seabirds; but it is merely a thin crust, gaining no great depth in a climate where rains are frequent and heavy.

No survey of the geological workings of plant and animal life upon the surface of the globe is complete which does not take account of the *Influence of man*—an influence of enormous and increasing consequence in physical geography, for man has introduced what seems superficially an element of antagonism to nature. Not content with gathering the fruits and capturing the animals which nature has offered for his sustenance, he has, with advancing civilization, engaged in a contest to subdue the earth and possess it. His warfare, indeed, has often been a blind one, successful for the moment, but leading to sure and sad disaster. He has, for instance, stripped the forests from many a region of hill and mountain, gaining his immediate object in the possession of their stores of timber, but exposing the slopes to parching droughts or fierce rains. Countries once rich in beauty and plenteous in all that was needful for his support, are now burnt and barren, or washed bare of their soil. But now when that truth is coming more and more to be recognized and acted on, man's influence is none the less marked. His object is still to subdue the earth; and he attains it, not by setting nature and her laws at defiance, but by enlisting her in his service. The action of man may be witnessed on climate, on the flow of water, on the character of the terrestrial surface, and on the distribution of life. Human interference affects meteorological conditions—by removing forests and laying bare to the sun and winds areas which were previously kept cool and damp under the trees, or which, lying on the lee side, were protected from tempests; as already stated, it is supposed that the wholesale destruction of the forests formerly existing in countries bordering the Mediterranean has been in part the cause of the desiccation of these districts by drainage, the effect of this operation being to remove rapidly the discharged rainfall, to lessen evaporation, and thereby to diminish the rainfall and somewhat increase the general temperature of a country; by the other processes of agriculture, such as the transformation of moor and bog into cultivated land, and the

clothing of bare hillsides with green crops or plantations of coniferous and hardwood trees. By increasing or diminishing the rainfall man directly affects the course of the waters over the land. By his drainage operations, he makes the rain to run off more rapidly than before, and thereby increases the floods in the rivers. By wells, bores, mines, or other subterraneous works he interferes with the underground waters and consequently with the discharge of springs. By embanking rivers he confines them to narrow channels, sometimes increasing their scour, and enabling them to carry their sediment further seaward, sometimes causing them to deposit it over the plains and raise their level. Man's operations alter the aspect of a country in many ways: by making forest-clad mountains bare, or clothing bare mountains with forest; by promoting the growth or causing the removal of peat-mosses; by heedlessly uncovering sand-dunes, and thereby setting in motion a process of destruction which may convert hundreds of acres of fertile land into waste sand, or by prudently planting the dunes with sand-loving vegetation or pines, and thus arresting their landward progress: by so guiding the course of rivers as to make them aid him in reclaiming waste land and bringing it under cultivation: by piers and bulwarks, whereby the ravages of the sea are stayed; or by the thoughtless removal from the beach of stones which the waves had themselves thrown up, and which would have served for a time to protect the land; by forming new deposits either designedly or incidentally. The roads, bridges, canals, railways, tunnels, villages, and towns with which man has covered the surface of the land will in many cases form a permanent record of his presence. Under his hand the whole surface of civilized countries is very slowly covered with a stratum, either formed wholly by him, or due in great measure to his operations, and containing many relics of his presence. The earth of old cities has been raised many feet by the rubbish of his buildings; the level of the streets of modern Rome stands high above that of the pavements of the Cæsars, and that again above the roadways of the early republic. Over cultivated fields his potsherds are turned up in abundance by the plow. The loam has risen within the walls of his graveyards, as generation after generation has moldered there into dust. It is on the *Distribution of Life*, perhaps, that the most subtle of human influences come. Some of man's doings in this domain are indeed plain enough, such as the extirpation of wild animals, the diminution or destruction of some forms of vegetation, the introduction of plants and animals useful to himself, and especially the enormous predominance given by him to the cereals and to the spread of sheep and cattle. But no such extensive disturbance of the normal conditions of the distribution of life can take place without carrying with it many secondary effects, and setting in motion a wide cycle of change and of reaction in the animal and vegetable kingdoms. For example, the incessant warfare waged by man against birds and beasts of prey in districts given up to the chase leads sometimes to unforeseen results. The weak game is allowed to live which would otherwise be killed off and give room for the more healthy remainder. Other animals which feed perhaps on the same materials as the game are by the same cause permitted to live unchecked, and thereby to act as a further hindrance to the spread of the protected species. But the indirect results of man's interference with the regime of plants and animals still require much prolonged observation.

Structural geology treats of the architecture of the earth's crust, beginning with stratification and its accompaniments; aqueous or sedimentary rocks are arranged in layers or strata, the strata expressing their leading structural feature. The general aspects of stratification will be best followed in an explanation of the terms by which they are expressed. *Laminæ* are the thinnest paper-like layers of deposit in a stratified rock. These layers will generally split apart, but sometimes are so compact that the rock breaks the soonest. *Laminæ* occur only where the material is fine grained, as in mud or shale. The existence of *laminæ* points to tranquil conditions of slow intermittent deposit. A great thickness of laminated rock, like the massive shales of paleozoic formation, points to a prolonged period of quiescence, and probably in most cases to slow and tranquil subsidence of the sea-floor. *Strata* or *beds* are layers of rock from an inch or less up to many feet in thickness. A stratum may be made of many laminæ, and this has commonly been the case where the sediment has been exceedingly fine-grained. Where the materials are of coarser grain, the strata, as a rule, are not laminated, but form the thinnest parallel divisions of the mass of rock. Strata are usually, with more or less ease, separable from each other. A stratum may be one of a series of similar beds in the same mass of rock, or may be complete and distinct in itself, as where one of limestone or iron-stone runs through the heart of a series of shales. As a general rule we may conclude that wherever, among sedimentary accumulations, stratification is exceedingly well marked, the rocks were formed rather slowly; and that where it is weak or absent, the conditions of deposit were more rapid, without the intervals and changes necessary for the production of the distinctly stratified structure. *False-bedding, current-bedding,* is where some strata, especially sandstones, are marked by an irregular lamination, wherein the laminæ, though for short distances parallel to each other, are oblique to the general stratification of the mass, at constantly varying angles and in different directions. Such a structure indicates frequent changes in the direction of the currents by which the sediment was carried along and deposited. *Irregularities of bedding,* due to *inequalities of deposition* or of *erosion*, indicate that a ridge of sand or gravel is laid down under water by current action of some strength. Should the motion of the water diminish, finer sediment may be brought to the place,

and be deposited around and above the ridge. In such a case the stratification of the latter accumulation will end off abruptly against the flanks of the older ridge, which will appear to rise up through the overlying bed. Appearances of this kind are not uncommon in some coal-fields, where they are known to miners as "rolls," "swells," or "horses' backs." A structure exactly the reverse occurs where a stratification has been scooped out before the deposition of the layers which cover it. Such channels have evidently been water-courses, worn out of the coal-measure strata, at a comparatively recent geological period, and subsequently buried under glacial accumulations. There is a complete discordance between them and the paleozoic strata below, pointing to the existence of a vast interval of time. *Ripple-marks* in sandstone are wavy ridges and hollows, such as may be seen on any shore from which the tide has retired. Their general direction suffices to indicate the quarter whence the chief movement of the water has come. Such indications of shallow-water conditions may often be observed among old crenaceous deposits, as in the Cambrian and Silurian rocks. *Sun-cracks, rain-pittings*, etc., prove that during deposition aqueous strata have been laid bare to the air and the sun. The nature and validity of this evidence will be best ascertained by observations made at the margin of the sea, or of any inland sheet of water, which, from time to time, leaves tracts of mud or fine sand exposed to sun and rain. Their existence in any strata proves that the surface of the rock on which they lie was exposed to the air and dried before the next layer of water-borne sediment was deposited upon it. Prints of rain-drops are often associated with these marks, and these serve sometimes to show from which direction the wind was blowing when the rain fell. Proofs of shallow shore-water, and of exposure to the air, are supplied by markings left by animals. Voidings and trails of worms, tracks of mollusks and crustaceans, fin-marks of fishes, footprints of birds, reptiles, and mammals, may all be preserved and give their evidence regarding the physical conditions under which sedimentary formations were accumulated.

Gas-spurts appear in some strata in the form of little heaps of various shapes, and are conjectured to be due to the intermittent escape of gas from decomposing organic matter in the original sand or mud, as we now sometimes see in the mud flats of rivers and estuaries. The *order of superposition* is the foundation of geological chronology. As strata are laid down upon one another in a more or less nearly horizontal position, the underlying beds must be older than those which cover them. This obvious truth is termed the "law of superposition," and furnishes the means of determining the chronology of rocks, and, though other methods are employed, they must all be based upon the observed order of superposition. The only cases where the apparent superposition may be deceptive is where the strata have been inverted. In the Alps, the rocks composing great mountain masses have been so completely overturned that the highest beds appear to be covered by others which ought properly to be underneath them. Such conditions, however, are exceptional. *Alternations of strata* show that certain repetitions occur with tolerable regularity. Sandstones are interleaved with shale above, and then pass into shale; the latter may become sandy at top and be finally covered with sandstone, or may become calcareous and pass into limestone. A sandstone group indicates water of comparatively little depth, moved by changing currents, and bringing the sand alternately from one side to the other. Limestone above the shale shows that the water cleared, owing to a deflection of the sediment-carrying currents, or to a continued and perhaps more rapid subsidence, and that corals, crinoids, mollusks, and other lime-secreting organisms established themselves upon the spot. Shale overlying limestone tells of fresh inroads of mud by which animal life was destroyed. In studying *associations of strata* we find that certain kinds commonly occur together, because the conditions under which they were formed were apt to arise in succession. A seam of coal is almost invariably found to lie in a bed of fire-clay, or on some argillaceous stratum. This is because the fire-clay formed the soil on which the plants grew that went to form the coal. When the clay was laid down under suitable circumstances vegetation sprang up upon it. Turning to the *relative persistence of strata* we observe that some kinds of sediment are much more widely spread than others, and therefore some kinds of sedimentary rocks possess far greater persistence than others. Usually the coarser the grain the more local the extension of the rock. Conglomerates are thus by far the most variable of all sedimentary formations. Sandstones are less liable to extremes, but are apt to thin out and then swell again. Shales are far more persistent, the same zone often being traceable for many miles. Limestones display remarkable continuity, and coal-seams often present remarkable persistence. *Overlap* is where strata have been laid down in a subsiding region wherein the area of deposit gradually increased, and the sediment spread over a progressively augmenting surface, whereby the later portions of a sedimentary series are extended over and repose upon the earlier portions. As to the *relative lapse of time* represented by strata and intervals between them, we can form no satisfactory estimates.

In all speculations in the case we must bear in mind that the length of time represented by a given depth of strata is not to be estimated merely from their thickness or lithological character. The intervals between the deposit of two successive laminæ of shale may have been as long as, or longer than, that required for the formation of one of the laminæ. In like manner, the interval needed for the transition from one stratum or kind of stratum to another may often have been more than equal to the time required

for the formation of the strata on either side. But the relative chronological importance of the bars or lines in the geological record can seldom be satisfactorily discussed merely on lithological grounds. This must mainly be decided on the evidence of organic remains. By this kind of evidence it can be made nearly certain that the intervals represented by strata were in many cases much shorter than those not so represented; in other words, that the time during which no deposit of sediment went on was longer than that wherein deposit did take place. Passing from individual strata to *groups of strata*, the geologist makes two bases of classification: 1. Lithological characters; 2. Organic remains. The first is uncertain, and everywhere variable. It is by the remains of plants and animals imbedded among the stratified rocks that the most satisfactory subdivisions of the geological record can be made. A chronological succession of organic forms can be made out among the rocks of the earth's crust. A certain common type is found to characterize particular groups of rock, and to hold true even though the lithological constitution of the strata should greatly vary. Moreover, though comparatively few species are universally diffused, they possess remarkable persistence over wide areas, and even when they are replaced by others, the same general facies of fossils remains. Hence the stratified formations of two countries geographically distant, and having little or no lithological resemblance to each other, may be compared and paralleled, zone by zone, simply by means of their inclosed organic remains.

Joints traverse all rocks, more or less distinctly, by vertical or highly inclined divisional planes. Soft rocks, such as loose sand and uncompacted clay, do not show these joint lines; but wherever a mass of clay has been subjected to some pressure and condensation, it will usually be found to have acquired them. It is by means of the intersection of joints that rocks can be removed in blocks, and the quarryman takes advantage of these natural planes of division.

The inclination of rocks would satisfy the most casual observer that the rocks now visible at the earth's surface are seldom in their original position. The inclination of rocks is termed their *dip*, and the amount is expressed in degrees measured from the plane of the horizon; thus rocks standing vertical have a dip of 90°. The edges of strata where they come to the surface are the *outcrop* or *basset*. A line drawn at right angles to the dip is called the *strike* of the rocks. Miners call this strike the *level course* or *level-bearing*. The movements which the crust of the earth has undergone have not only folded up and corrugated the rocks, but have fractured them in all directions; the result being called *dislocations of rocks*. These dislocations may be simple *fissures*, that is, rents without any vertical displacement of the mass on either side; or may be *faults*, that is, rents where one side has been pushed up or has sunk down. Another system of divisional planes is known as *cleavage*, by which rocks are sometimes traversed. When this cleavage is well developed it divides the rock into parallel laminæ, which run at a high angle quite independently of stratification or any other divisional planes. Cleavage is most perfect in fine-grained material, hence it is admirably shown in argillaceous rocks. With regard to *igneous rocks* as a part of the structure of the earth's crust, the general law which has governed their intrusion within the crust may be thus stated: Every fluid mass impelled upwards by pressure from below, or by the expansion of its own imprisoned vapor, has sought egress along the line of least resistance. What that line was to be, has depended in each case upon the structure of the terrestrial crust and the energy of the eruption. In many instances it has been determined by an already existing dislocation; in others by the planes of stratification; or by the surface of junction of two inconformable formations, or by irregular rents and cracks, or by the more complex lines of weakness. Sometimes the intruded mass has actually fused and obliterated some of the rock which it has invaded, incorporating such portion into its own substance. The shape of the channel of escape has necessarily determined the form of the intrusive rock, as the mold regulates the form of a casting of molten iron. Igneous rocks may be arranged under four heads, according to the shape in which they have solidified: 1. Amorphous masses; 2. Sheets; 3. Veins and dykes; 4. Necks. The first are chiefly crystalline coarse-textured rocks, of which granite and syenite are the most conspicuous; sheets are masses of crystalline rock intruded between other rocks. Many of the older volcanic rocks occur in this form, such as feldstone, quartz, porphyry, dolerite, basalt, and others. Coal seams, when invaded by intruded sheets of igneous matter, assume different aspects, according to the thickness and nature of the invading sheet, the depth of the coal seam, and other conditions. In some cases the coal has been fused, and has acquired a blistered or vesicular texture, the gas cavities being either empty or filled with mineral matter, such as calcite. In other cases the coal has nearly disappeared, the remaining portion being black soot or ashes. In others, still, it has become hard and brittle, and has been converted into a kind of anthracite, owing to the loss of its more volatile portions. Veins of igneous rock may occur indifferently in igneous, aqueous, or metamorphoric rocks, and range in diameter from thread-like filaments to masses many feet or yards across. There are veins of segregation and veins of intrusion. Those of segregation are peculiar to crystalline rocks; they abound in many granites, and are found in gneiss and schist. They run as straight, curved, or branching ribands, seldom exceeding a foot in thickness. Most frequently they are finer in texture than the rock which they traverse, but occasionally the reverse is the case; especially in granite. These veins are so welded to the rock that they cannot

easily be separated along the plane of union. Veins of intrusion are portions of once melted matter injected into rents in previously solidified rocks. *Dykes* are wall-like masses of igneous rock, filling vertical or highly inclined fissures. They present as great a variety of thickness as is shown by the veins. Sometimes they occur as plates of rock only an inch or two in thickness; at other times they attain a breadth of ten or twelve fathoms. The name is given because the formation presents the appearance of a wall, and their sides are often as parallel and perpendicular as those of a piece of masonry. *Necks* are the filled up pipes or funnels of former volcanic vents. When a volcano ceases action its vent is left full of igneous matter which soon solidifies. The wash of surface by rains and other agencies in old volcanic regions has laid these necks bare. They are usually circular or elliptical, but occasionally of a more branching or irregular form. The materials are sometimes crystalline, sometimes fragmental, and there may be some form of lava. The fissures which so abundantly traverse the crust of the earth have, in many instances, served as places for the deposit of mineral matter forming *mineral veins.* These veins or lodes vary in thickness from less than an inch up to fathoms, and the same vein may, in not far separated parts, have both extremes of thickness. Such veins usually send out shoots, and in some mining districts this has been done to such an extent that it becomes hardly possible to identify the main vein among its numerous offshoots. In some rocks, more especially in limestones, large subterranean cavities have been filled with veinstones and ore. Various theories have been proposed to account for the infilling of mineral veins. Of these, the most noteworthy are: 1. The theory of lateral segregation, which teaches that the substances in the veins have been derived from the adjacent rocks by a process of solution and redeposit; and, 2. The theory of filling from below, according to which the minerals and ores were introduced from below, dissolved in water or steam, or by sublimation, or by igneous fusion and injection. The fact that the nature and amount of the minerals, and especially of the ores in a vein, vary with the nature of the surrounding rocks, seems to show that such rocks have had a certain influence on the precipitation of mineral matter in the fissures passing through them; but that this mineral matter came chiefly from below appears almost certain. The phenomena of the ascent of hot water in volcanic districts afford a close analogy to what has occurred in mineral veins. It is known that at the present time various minerals, including silica, both crystalline and calcedonic, and various metallic sulphides, are being deposited in fissures up which hot water rises. At the same time it is conceivable that to some extent there may be a decomposition of the rocks on either side of a fissure, and that a portion of the mineral matter abstracted may be laid down in another form along the walls of the fissure, or, on the other hand, that the rocks on either side of the fissure may be permeated for some distance by the ascending waters, and that some of the mineral substances carried up in solution may be deposited in the pores and cavities of these rocks as well as in the fissure itself. The last division to notice under structural geology is *unconformability.* Where one series of rocks has been laid down continuously and without disturbance upon another series they are said to be "conformable." Though such rocks may usually be presumed to have followed each other continuously without any great disturbance of geographical condition, we cannot always be safe in such an inference. But an unconformability leaves no room to doubt that it marks a decided break in the continuity of deposit. Hence, no kind of geological structure is of higher importanee in the interpretation of the history of the stratified formations of a country. Paramount, though, the effect of unconformability may be in the geological structure of a country, it must nevertheless be in almost all cases local. The disturbance by which it was produced can have affected but a comparatively circumscribed region, beyond the limits of which the continuity of sedimentation may have been undisturbed.

Paleontological Geology treats of the structure, affinities, classification, and distribution in time of the forms of vegetable and animal life imbedded in the rocks of the earth's crust, dealing chiefly with fossils. The first question that naturally suggests itself is: How came the remains of plants and animals to be preserved in these old rocks? If we argue from the conditions of the present day, and suppose such conditions to have prevailed in the ancient time, we are not satisfied or enlightened as to such remarkable preservation. The conditions for the preservation of any relics of plant or animal life of a terrestrial surface must be always exceptional. They are supplied only where the organic remains can be protected from the air and from superficial decay. Hence fossils may be found in lakes over the bottoms of which deposits of silt, peat, marl, etc., are formed. Peat mosses are more favorable still for the preservation of ancient fauna. In them wild animals have sunk, and the antiseptic quality of the peat has preserved them from decay. Fauna and flora may be buried in the sand and silt of deltas at the mouths of rivers. Caverns are particularly adapted to the preservation of the higher forms of animal life. Most of our knowledge of the pre-historic mammalian fauna of Europe is derived from what has been disinterred in bone caves. These caves serve as dens for predatory beasts, into which they dragged their prey. In some cases they were merely holes into which animals crawled to die, or in which they were deluged and drowned. The bottom of the sea below tide-mark is favorable to the preservation of marine organisms; and the fossils of the ocean are vastly greater in variety and number and of much more importance in geological study than those of the land. As to the *relative age of fossils,* although absolute dates cannot be fixed in geological chronology, it

is not difficult to determine the relative age of different strata, and consequently of their inclosed organic remains. For this purpose the fundamental law is based on what is termed the "order of superposition." This law may be thus defined: In a series of stratified formations the older must underlie the younger. It is not needful that we should actually see the one lying below the other. If a continuous conformable succession of strata dip steadily in one direction we know that the beds at the one end must underlie those at the other, because we can trace the whole succession of beds between them. The true order of superposition is decisive of the relative ages of stratified rocks. There is nothing in fossils themselves to fix their date; but it is certain that those in the younger strata were ages later in appearance on the earth than those in the older strata. There are two main purposes to which fossils may be put in geological research: 1, to throw light upon former conditions of physical geography, such as the presence of land, rivers, lakes, and seas, in places where they do not now exist; changes of climate, and the former distribution of plants and animals; and, 2, to furnish a guide in geological chronology whereby rocks may be classified according to relative date, and the facts of geological history may be arranged and interpreted as a connected record of the earth's progress. Former land surfaces are revealed by the presence of stumps of trees with roots branching freely in the underlying stratum, which, representing the ancient soil, often contains leaves, fruits, and other sylvan remains, together with traces of the bones of land animals, remains of insects, land-shells, etc. Ancient woodland surfaces of such character are found between tidemarks, and even below low-water line. They unequivocally prove a subsidence of the land. The former existence of lakes can be satisfactorily proved from beds of marl or lacustrine limestone, full of fresh-water shells, or from fine silt with leaves, fruits, and insect remains. Such deposits are abundantly forming at the present day, and they occur at various horizons among the geological formations of past times. Old sea-bottoms are vividly brought before us by beds of marine shells and other organisms. Layers of water-worn gravel and sand, with rolled shells of littoral and infra-littoral species, unmistakably mark the position of a former shore line. Deeper water is indicated by finer muddy sediment, with relics of the fauna which prevailed beneath the reach of waves and ground-swell. Limestones full of corals, or made up of crinoids, point to the slow continuous growth and decay of generation after generation of organisms in clear sea water. The existence of different conditions of climate in former geological periods is satisfactorily demonstrated from the testimony of fossils. Thus an assemblage of the remains of palms, gourds, and melons, with bones of crocodiles, turtles, and sea-snakes, proves a sub-tropical climate to have prevailed over the s. of England in the time of the older tertiary formations. On the other hand, the presence of an intensely cold or arctic climate far s. in Europe during post-tertiary time, can be shown from different kinds of evidence, such as the existence of the remains of arctic animals even as far as France. Observations made over a large part of the globe have enabled geoligists to divide the stratified part of the earth's crust into systems, formations, and groups, or series; and it is by their characteristic fossils that the divisions of stratified rocks can be most satisfactorily made, since each formation, being followed and distinguished by its own assemblage of organic remains can be followed and recognized even amid the crumblings and dislocations of a disturbed region. It was at one time believed, and many still hold, that groups of strata characterized by community or resemblance of organic remains were chronologically contemporaneous. But such an inference rests upon most insecure grounds. We may not be able to disprove the assertion that the strata were strictly coeval, but we have only to reflect on the present conditions of zoological and botanical distribution, and of modern sedimentation, to be assured that the assertion of contemporaneity is a mere assumption. Consider what would happen were the present surface of any portion of southern Europe to be submerged by the sea, covered by marine deposits, and then re-elevated into land. The river-terraces and lacustrine marls formed before the time of Julius Cæsar could not be distinguished by any fossil tests from those laid down in modern days, unless traces of human implements were obtainable, whereby the progress of civilization during 2,000 years might be indicated. So far as regards the shells, bones, and plants preserved in the various formations, it would be absolutely impossible to discriminate their relative dates; they would be classed as "geologically contemporaneous," that is, as having been formed during the same period in the history of life in the European area; yet there might be a difference of 2,000 years or more between many of them. Strict contemporaneity cannot be asserted of any strata merely on the ground of similarity or identity in fossils. Still it may be true that lake or sea deposits of widely different characteristics may have been contemporaneous in the time of their deposition, as a lake bottom in America might show certain types of fossils, while an entirely different assortment might at the same period have been settling into the bottom of a lake in Asia. But the grand march of life, in its progress from lower to higher forms, has unquestionably been broadly alike in all quarters of the globe. But nothing seems more certain than that the rate of advance has not everywhere been the same. It has moved unequally over the same region. A certain stage of progress may have been reached in one quarter of the globe thousands of years before it was reached in another; though the same general succession of organic forms might be found in each region. The geological formations form the records of these ages of organic development. In every country

where they are fully displayed and have been properly examined, they can be separated from each other according to their organic contents. Their relative age within a limited geographical area can be demonstrated by the mere law of superposition. Where, however, the formations of distant countries are composed, all that we can safely affirm regarding them is that those containing the same or a representative assemblage of organic remains belong to the same epoch in the history of biological progress in each area; but we cannot assert that they are contemporaneous, unless we are prepared to include within that term a vague period of perhaps thousands of years. *Gaps in the geological record* show that the history of life has been very imperfectly preserved in the stratified parts of the earth's crust. Apart from the fact that, even under the most favorable conditions, only a small proportion of the total flora and fauna of any period could be preserved in the fossil, enormous breaks occur where no record has been preserved at all. It is as if whole chapters and books were missing from a historical work. Fossil evidence, moreover, may be made to prove the existence of gaps which are not otherwise apparent. Changes in organic forms must, on the whole, have been extremely slow in the geological past. The whole species of a sea-floor could not pass entirely away and be replaced by other forms without the lapse of long periods of time. If then among the conformable stratified formations of former ages we encounter sudden and abrupt changes in the facies of the fossils, we may be certain that these must mark omissions in the record, which we may hope to fill in from a more perfect series elsewhere. There have never been any universal interruptions in the continuity of the chain of being, so far as geological evidence can show. But the physical changes which caused the breaks may have been general over a zoological district or minor region. They no doubt often caused the complete extinction of genera and species which had a small geographical range. It is therefore clear that the geological record, as it now exists, is at the best but an imperfect chronicle of geological history. In no country is it complete. The lacunæ of one region must be supplied from another; yet in proportion to the geographical distance between the localities where the gaps occur and those whence the missing intervals are supplied, the element of uncertainty in our reading of the record is increased. The most desirable method of research is to exhaust the evidence for each area or province, and to compare the general order of its succession as a whole with that which can be established for other provinces. It is therefore only after long and patient observation and comparison that the geological history of different quarters of the globe can be correlated. *Subdivisions of the geological record* are made by fossils, and they are made the bases for the geological classification of rocks. Thus we may find a particular stratum marked by the occurrence in it of various fossils, one or more of which may be distinctive, either from occurring in no other bed above and below, or from special abundance in that stratum. These species might be used as a guide to the occurrence of the bed in question, which might be called by the name of the most abundant species. In this way a geological horizon or zone would be marked off, and geologists would thereafter recognize its exact position in the series of formations. The first and fundamental point is to determine accurately the order of superposition of strata. Until this is done, detailed paleontological classification may prove to be worthless. But when once the succession of the rocks has been fixed, paleontological evidence may become paramount. It cannot be too frequently stated nor too prominently kept in view that, although gaps occur in the succession of organic remains as recorded in the rocks, there have been no such blank intervals in the progress of plant and animal life upon the globe. The march of life, onward and upward, has been unbroken. Geological history, therefore, if its records in the stratified formations were perfect, ought to show a blending and gradation of epoch with epoch, so that no sharp divisions of the events could be made. But the progress has been constantly interrupted, now by upheaval, now by volcanic outbreaks, now by depression. These interruptions serve as natural divisions in the chronicle, and enable the geologist to arrange his history into periods. A bed, or limited number of beds, characterized by one or more distinct fossils, is termed a zone or horizon, and is often known by the name of a typical fossil, as the different zones in the Lias are by their special species of ammonite. A series of such zones, united by the occurrence among them of a number of the same species or genera, is called a *group*. A series of groups similarly related constitute a *formation*, and a number of formations may be united into a *system*.

Stratigraphical geology arranges the rocks of the earth's crust in the order of their appearance, and interprets the sequence of events of which they form the records. Its province is to cull from all the other departments of geology the facts which may be needed to show what has been the progress of our planet, and of each continent and country, from the earliest times of which the rocks have preserved any memorial. Thus from mineralogy and petrography it obtains information regarding the origin and subsequent mutations of minerals and rocks; from dynamical geology it learns by what agencies the materials of the earth's crust have been formed, altered, broken, upheaved, and melted; from structural geology it understands how these materials were put together so as to build up the complicated crust of the earth; from paleontological geology it receives, in well-determined fossil remains, a clew by which to discriminate the different stratified formations and to trace the grand onward march of organized existence upon this planet. Though the geological record is at best but an imperfect chronicle of the history of the earth, from this record alone can the progress of the globe be traced. It

contains the registers of the births and deaths of tribes of plants and animals which have from time to time lived on our planet. But a small proportion of the total number of species which have appeared in past time have been thus chronicled, yet by collecting the broken fragments of the record an outline at least of the history of life upon the earth can be deciphered. The nomenclatures adopted for the subdivisions of the geological record bear witness to the rapid growth of geology. It is a patch-work in which no system nor language has been adhered to, but where the influence by which the progress of the science has been molded may be distinctly traced. Some of the earliest names are lithological, and remind us of the fact that mineralogy and petrography preceded geology in the order of birth—chalk, oolite, greensand, millstone grit. Others are topographical, and often recall the labors of the early geologists of England—London clay, Oxford clay, Purbeck, Portland, Kimmeridge beds. Others are taken from local English provincial names—Lias, Gault, Crag, Cornbrash. Others of later date recognize an order of superposition as already established among formations —old red sandstone, new red sandstone. By common consent it is admitted that names taken from the region where a formation or group of rocks is typically developed, are best adapted for general use. Cambrian, Devonian, Silurian, Permian, Jurassic, are of this class, and have been adopted all over the globe. The geological record is classified into five main divisions: 1. The archæan, azoic (lifeless), or eozoic (dawn of life) periods; 2. The primary or paleozoic (ancient life) periods; 3. The secondary or mesozoic (middle life) periods; 4. The tertiary or post-tertiary periods. These divisions are further arranged into systems, each system into formations, each formation into groups, and each group or series into single zones or horizons. The subjoined generalized table exhibits the order in which the chief subdivisions appear:

ORDER OF SUCCESSION OF THE STRATIFIED FORMATION OF THE EARTH'S CRUST.

	Britain.	Continental Europe.	North America.
Post-Tertiary, or Quaternay.	Recent—Alluvium, peat, etc.	Alluvium.	Recent or Terrace.
	Pleistocene—*Cave deposits, Glacial orbit.*	Diluvium.	Champlain. Glacial.
Tertiary, or Cainozoic.	Pliocene—*Crag deposits of Norfolk and Suffolk.*	Pliocene—*Tegel, Dinotherium, Sand.* Miocene—*Leithakalk, Upper Molasse.*	Sumter. Yorktown.
	Miocene—*Lignite of Bovey Tracey, Mull, etc.*	Oligocene—*Lower Molasse, Gres de Fontainebleu, etc.*	
	Eocene—*Tertiaries of Hampshire Basin and Isle of Wight.*	Eocene — *Nummulite, Limestone, Flysch.*	Alabama. Lignitic.
Secondary, or Mesozoic.	Cretaceous .... Upper.	Senonian—*Craie blanche et tuffeau. Upper Quadersandstein.* Turonian—*Planerkalk.*	Fox Hills group. Pierre group. (Upper Missouri Region.)
	Cretaceous .... Lower.	Cenomanian—*Grès vert.* Gault.	Niobrara group. Benton group. (Upper Missouri Region.)
	Jurassic. Oolitic .... Upper.	Neocomian.	Dakotah group. (Upper Missouri Region.)
	Jurassic. Oolitic .... Lower.	Upper or White Jura (Malm). Middle or Brown Jura (Dogger).	Jurassic rocks appear to be but poorly developed in North America.
	Jurassic. Liassic..................	Lower or Black Jura (Lias).	
	Triassic............. Upper.	Rhætic beds, Keuper. Muschelkalk.	
	Triassic............. Lower.	Bunter.	Triassic.
Primary, or Paleozoic.	Permian.	Dyas or Permian. { *Zechstein. Rothliegendes.*	Permian.
	Carboniferous. Coal measures.........	Terrain houiller, Steinkohlen.	Carboniferous.
	Carboniferous. Millstone grit..........	Flötzleerer Sandstein.	Sub-carboniferous.
	Carboniferous. Carboniferous limestone.	Calcaire, Carbonifère, Kohlenkalk, Kulm.	
		Devonian.	Devonian.
	Devonian and Old Red sandstone.	Silurian (Transition or Grauwacke system).	Silurian.
	Silurian.	Primordial Silurian (older Grauwacke and slate).	Primordial Silurian and Cambrian.
	Cambrian.	Primitive Schists.	Huronian.
Archæan, or Azoic (Eozoic).	Fundamental gneiss.........	Ur. gneiss.	Laurentian.

Physiographical geology deals chiefly with the surface of the earth and the changes thereon. When the geologist asks himself how the present distribution of sea and land is to be accounted for, he finds that the answer of the question goes back to early paleozoic times, whence he can in some cases trace the growth of a continent downward through the long cycles of geological time. But there still remains the problem of the original wrinkling of the surface of the globe, whereby the present great ridges and hollows were produced. It is generally agreed that these inequalities have been produced by unequal contraction of the earth's mass, the interior contracting more than the outer crust, which must therefore have accommodated itself to this diminution of diameter by undergoing corrugation. But there seems to have been some original distribution of materials in the globe that initiated the depressions on the areas which they have retained. The matter underlying the oceans is more dense than that beneath the continents, and to this cause, in part at least, must the present position of the oceans be attributed. The early and persistent subsidence of these areas, with the consequent increase of density, seems to have determined the main contours of the earth's surface. Rocks which were originally horizontal, or nearly so, have been crumpled over tracts thousands of square miles in extent, so as to occupy a superficial area greatly less than that which they originally covered. It is evident that they have been horizontally compressed, and that this result can have been achieved only as a consequence of the subsidence of such a curved surface as that of our globe. One writer of eminence supposes that the present inequalities of contour on the earth's surface are from 11½ to 66 times as great as they would have been had they resulted from the contraction of a solid globe; and he has suggested that the earth need not have become solid throughout simultaneously, and consequently may have been considerably larger at the time when a solid crust was formed than it is now. The theory of a hot fluid interior of the earth, so long and so resolutely held by geologists as well as laymen, has in recent times been weightily opposed. But it is the surface and not the interior that we are now considering. The hypothesis of secular cooling and contraction furnishes a natural explanation of the origin of the dominant elevations and depressions on the surface, and of the intense crumpling which the rocks in many regions have undergone. Taking 0.09 as the coefficient of contraction for a supposed stratum 500 m. thick, lying beneath 25 m. of crust, and passing from a fused into a solid state, one investigator concludes that every hundred miles measured along a great circle on the surface would have been one mile longer before the contraction, and that this might produce a triangular elevation of 25 sq.m. on a base of 100 m., which would give a range of mountains half a mile high. If only 50 m. out of the 100 were disturbed, the range would be a mile high, and so on. The effects of this lateral pressure may show themselves either in broad domelike elevations, or in narrower and loftier ridges of mountain. The structure of the crust is so complex and the resistance offered by it to the pressure is consequently so varied, that abundant cause is furnished for almost any diversity in the forms and distribution of the wrinkles into which it is thrown. It is evident, however, that the folds have tended to follow a linear direction. In North America, from early geological times, they have kept on the whole on the lines of meridians of longtitude; in the old world they have chosen diverse trends, but the last great crumplings—those of the Alps, Caucasus, and the great mountain ranges of central Asia—have risen along parallels of latitude. Mountain chains must, therefore, be regarded as evidence of the shrinkage of the earth's mass. The theory of secular contraction serves also to show why volcanoes so frequently rise along the mountain ridges. The elevation of the crust, by diminishing the pressure on the parts underneath the upraised tracts, permits them to assume a liquid condition and to rise within reach of the surface, when, driven upwards by the expansion of superheated vapors, they are ejected in the form of lava or ashes. But these subterranean movements form only one phase of the operations by which the outlines of the land have been produced. They have ridged up the solid crust above the sea-level, and have thus given rise to land; but the land as we now see it has acquired its features from the prolonged and varied action of the epigene agents upon rocks of widely varied heights and powers of resistance. It is evident that as a whole the land suffers ceaseless erosion from the time that it appears above water. It is likewise clear, from the nature of the materials composing most of the rocks of the land, that they have been derived from old denundations of the same kind, and thus, side by side with the various upheavals and subsidences, there has been a continuous removal of materials from the land and an equally persistent deposit of these materials under water, and consequent growth of new rocks. The work of rain, of frost, of rivers, of glaciers can be readily discriminated, though they all combine harmoniously toward the achievement of their common task. Taking a broad view of denudation, we may conveniently group together the action of air, frost, springs, rivers, glaciers, and the other agents which wear down the surface of the land, under the common designation of subaerial, and that of the sea as marine. The general results of subaerial action are—to furrow and channel the land, to erode valleys, to sharpen and splinter the ridges of mountains, and thus, while roughening, to lower the general surface and carry the detritus out to sea. The action of the sea, on the other hand, is to plane down the land to the level at which the influence of breakers and ground-swell ceases to have any erosive effect; the flat platform so often visible between tide-marks on a rocky exposed

coast-line, is an impressive illustration of the tendency of marine denudation. The combined result of subaerial and marine action, if unimpeded by any subterranean movement, would evidently be to reduce the land to one general level under the sea. But to reduce a continent to the condition of a submarine plain would require a longer period of time than seems to have elapsed between any two epochs of upheaval. An idea of the magnitude of surface denudation is found in the action of the great Mississippi river, which, it has been estimated, wears away every year from the vast territory drained by it $\frac{1}{6000}$th of a foot. At this rate, and taking Humboldt's estimate of 748 ft. as the average height of the continent, the whole of North America would be worn down to the sea-level in about 4,500,000 years—a comparatively short period in geological chronology. Hence it follows that, apart altogether from irregularities of surface due to inequalities of upheaval, every area of land exposed to ordinary subaerial action must in the end be channeled into a system of valleys. Nor would this require a long geological period, for, at the present rate of waste in the Mississippi basin, valleys 800 ft. deep might be made in a million years. Undoubtedly the original features superinduced by subterranean action would guide and modify the operations of running water, though their influence would certainly wane as the features themselves slowly disappeared. In no case, probably, would the aboriginal contour remain through a succession of geological periods. Traces of it might still be discernible, but they would be well nigh effacted by the new outlines produced by the superficial agents. In the vast table lands of Colorado and the western territories of the United States is an impressive picture of the results of mere subaerial erosion on undisturbed and nearly level strata. Systems of stream-courses, and valleys, river gorges unexampled elsewhere in the world for depth and length, vast winding lines of escarpment, like ranges of sea-cliffs, terraced slopes rising from plateau to plateau, huge buttresses and solitary stacks standing like islands out of the plains, great mountain masses towering into picturesque peaks and pinnacles, cleft by innumerable gullies, yet everywhere marked by the parallel bars of the horizontal strata out of which they have been carved, these are the orderly symmetrical characteristics of a country where the scenery is due entirely to the action of subaerial agents on the one hand and the varying resistance of perfectly regular stratified rocks on the other. The Alps, on the contrary, present an instructive example of the kind of scenery that arises where a mass of high ground has resulted from the intense corrugation and upheaval of a complicated series of stratified and crystalline rocks, subsequently for the vast period carved by rain, frost, springs, and glaciers. We see how, on the outer flanks of those mountains among the ridges of the Jura, the strata begin to undulate in long wave-like ridges, and now, as we enter the main chain, the undulations assume a more gigantic tumultuous character, until, along the central heights, the mountains lift themselves towards the sky, like the storm-swept crest of vast earth billows. The whole aspect of the ground suggests intense commotion. Where the strata appear along the cliffs or slopes, they may often be seen twisted and crumpled on the most gigantic scale. Out of this complicated mass of material, the subaerial forces have been ceaselessly at work since its first elevation. They have cut out valleys, sometimes along the original depressions, sometimes down the slopes. They have eroded lake basins, dug out corries or *cirques*, notched and furrowed the ridges, splintered the crests, and have left no part of the original surface unmodified. But they have not effaced all traces of the convulsions in which the Alps were upheaved. The details of the sculpture of the land have mainly depended on the nature of the materials on which nature's erosive tools have been employed. The joints by which all rocks are traversed have served as dominant lines along which the rain has filtered, and the springs have risen, and the frost wedges have been driven. On the high bare scarps of a high mountain, the inner structure of the mass is laid open, and there the system of joints is seen to have determined the lines of crest, the vertical walls of cliff and precipice, the forms of buttress and recess, the position of cleft and chasm, the outline of spire and pinnacle. On the lower slopes, even under the tapestry of verdure which nature delights to hand where she can over her naked rocks, we may detect the same pervading influence of the joints upon the forms assumed by ravines and crags. Each kind of rock, too, gives rise to its own characteristic scenery. The massive crystalline rocks, such as granite, yield each in its own fashion to the resistless attacks of the denuding forces. They are broadly marked off from the stratified rocks in which the parallel bands of the bedding form a leading feature in every cliff and bare mountain slope. Among the latter rocks also, very distinctive types of surface may be observed. A range of sandstone hill, for example, presents a marked contrast to one of limestone. In the physiography of any region, the mountains are the dominant features. A true mountain chain consists of rocks which have been crumpled and pushed up in the manner already described. But ranges of hills almost mountainous in their bulk may be formed by the gradual erosion of valleys out of a mass of original high ground. In this may some ancient table-lands, those of Norway and of the Highlands of Scotland, for example, have been so channeled by deep fjords and glens that they now consist of massive, rugged hills, either isolated or connected along the flanks. The forms of the valleys thus eroded have been governed partly by the structure and composition of the rocks, and partly by the relative potency of the different denuding agents. Where the influence of rain and frost has been slight, and the streams, supplied from distant

sources, have had sufficient declivity, deep, narrow, precipitous ravines or gorges have been excavated. The cañons of the Colorado are a magnificent example of this result. Where, on the other hand, ordinary atmospheric action has been more rapid, the sides of the river channels have been attacked, and open sloping glens and valleys have been hollowed out. A gorge or defile is usually due to the action of a waterfall, which, beginning with some abrupt declivity or precipice in the course of the river when it first commenced to flow, or caused by some hard rock crossing the channel, has eaten its way backward. Lakes may have been formed in several ways. 1. By subterranean movements, as, for example, during those which gave rise to mountain chains. But these hollows, unless continually deepened by subsequents movements of a similar nature would be filled up by the sediment continually washed into them from the adjoining slopes. The numerous lakes in such a mountain system as the Alps cannot be due merely to this cause, unless we suppose the upheaval of the mountains to have been geologically quite recent, or that subsidence must take place continuously or periodically below each independent basin. But there is evidence that the upheaval is not of recent date, while the idea of perpetuating lakes by continual subsidence would demand, not in the Alps merely, but all over the northern hemisphere where lakes are so abundant, an amount of subterranean movement of which, if it really existed, there would assuredly be—as there is not—plenty of other evidence. 2. By irregularities in the deposition of superficial accumulations prior to the elevation of the land or during the disappearance of the ice-sheet. The numerous lakes inclosed within ridges and mounds of drift clay and gravel, are examples. 3. By the accumulation of a barrier across the channel of a stream, and the consequent holding back of the water. This may be done, for instance, by a landslip, by the advance of a glacier across a valley, or by the throwing up of a bank, by the sea, across the mouth of a river. 4. By erosion. The only agent capable of excavating hollows out of the solid rock, such as might form lake-basins, is glacier-ice. It is a remarkable fact, of which the significance may now be seen, that the innumerable lake-basins of the northern hemisphere lie on surfaces of intensely ice-worn rock. The striæ can be seen on the smoother rock-surfaces running down into the water on all sides. These striæ were produced by ice moving over the rock. If the ice could, as the striæ prove, descend into the rock basins and mount up the farther side, smoothing and striating the rock as it went, it could erode the basins. It is hardly possible to convey in words an adequate conception of the enormous extent to which the north of Europe and North America have had their surfaces ground down by ice. The ordinary rough surfaces produced by atmospheric disintegration have been replaced by a peculiar flowing contour, which is traceable even to below the sea-level. The table-lands may sometimes arise from the abrasions of hard rocks and the production of a level plain by the action of the sea, or rather of that action combined with the previous degradation of the land by subaerial waste. But most of the great table-lands of the globe seem to be platforms of little disturbed strata which have been upraised bodily to a considerable elevation. No sooner, however, are they placed in that position than they are attacked by running water, and begin to be hollowed out into systems of valleys. As the valleys sink, the platforms between them grow into narrower and more definite ridges, until eventually the level table-land is converted into a complicated network of hills and valleys, wherein, nevertheless, the key to the whole arrangement is furnished by a knowledge of the disposition and effects of the flow of water. The examples of this process brought to light in the states of Colorado and Nevada, and in Wyoming and the other western territories, by Newberry, King, Hayden, Powell, and other explorers, are among the most striking monuments of geological operations in the world. The materials worn from the surface of the higher are spread out over the lower grounds. We have already traced how streams at once begin to drop their freight of sediment when, by the lessening of their declivity, their carrying power is diminished. The great plains of the earth's surface are due to this deposit of gravel, sand, and loam. They are thus monuments at once of the dsstructive and reproductive processes which have been in progress unceasingly since the first land rose above the sea, and the first shower of rain fell. Every pebble and particle of their soil, once part of the distant mountains, has traveled slowly and fitfully downward. Again and again have these materials been shifted, ever moving downward and seaward. For centuries, perhaps, they have taken their share in the fertility of the plains and have ministered to the necessities of flower and tree, of the bird of the air, the beast of the field, and of man himself. But their destiny is still the great ocean. In that bourne alone can they find undisturbed repose, and there, slowly accumulating in massive beds, they will remain until, in the course of ages, renewed upheaval shall raise them into future land, there once more to pass through the same cycle of change.—[In large part condensed from *Encyclopædia Britannica*, 9th edition.]

GE'OMANCY. See DIVINATION.

GEOMETRICAL, related to geometry (q.v.), as a geometrical line, demonstration, construction, etc. As to geometrical lines, see CO-ORDINATES, CURVES, and DEMONSTRATION. Geometrical constructions and solutions were anciently such as were effected by means of the straight line and circle—the only lines which were regarded as properly geometrical—and according to the strict rules of geometry. The ancient geometers

employed two methods of reasoning in their inquiries and demonstrations, known as *geometrical analysis* and *synthesis*. Of these, the synthetical method was the older and more generally employed. It is abundantly illustrated in Euclid's *Elements*, in which new truths are deduced from combinations of truths already established, so that every proposition depends on others preceding it. See SYNTHESIS. Though admirably suited for the demonstration of truth once ascertained, this method was found of little use in the discovery of truth, or of the mode of its demonstration. For these purposes, the analytical method is admirably adapted. See ANALYSIS. According to this method, the proposition which is to be proved is assumed to be true, or the construction required is supposed to be effected; and then the conditions of the proposition being true, or the construction effected, are investigated by reasoning backwards till some elementary truth or simple construction is reached, on which the truth or construction under inquiry is seen to depend. The analytical method of reasoning in geometry is said to have been invented by Plato. The Greeks have left on record many proofs of the power and beauty of the method as a means of discovery.

GEOMETRICAL MEAN of two numbers is that number the square of which is equal to the product of the two numbers; thus, the geometrical mean of 9 and 16 is 12, for $9 \times 16 = 144 = 12^2$; hence the geometrical mean of two numbers is found by multiplying the two numbers together, and extracting the square root of the product.

GEOMETRICAL PROGRESSION. A series of quantities are said to be in geometrical progression when each term of the series is equal to that which precedes it multiplied by some constant factor—i e., some factor which is the same for all the terms; or, in other words, when the ratio of any two successive terms is the same. Thus $a, ar, ar^2, ar^3\ldots$ and 2, 6, 18, 54... are geometrical series. The sum of n terms of the former series may be easily obtained. Let it be S. Then $S = a + ar + ar^2 + \ldots + ar^{n-1}$. Multiply both sides by r, we have $rS = ar + ar^2 + \ldots + ar^n$. Subtracting the former of these expressions from the latter, we have $(r-1)\,S = ar^n - a$. Whence we have $S = a.\dfrac{r^n - 1}{r - 1}$. If the series be one whose terms constantly diminish, i.e., if $r \angle 1$, and then if we suppose n indefinitely great, r^n will be indefinitely small, and we shall have $S = \dfrac{a}{1-r}$ for the sum of the series extended *ad infinitum*. For example, the sum of the series $\dfrac{8}{10} + \dfrac{8}{10^2} + \dfrac{8}{10^3} + \ldots$ *ad infinitum* is $\frac{8}{9}$. It is obvious that any three of the four quantities a, r, n, S being given, the equation $S = a\,.\,\dfrac{r^n - 1}{r - 1}$ will enable us to find the fourth.

GEOMETRICAL TRACERY, a name frequently used to distinguish a class of tracery where the parts are all more or less like diagrams in geometry. See TRACERY.

GEOMETRY, the science of space, discusses and investigates the properties of definite portions of space under the fourfold division of lines, angles, surfaces, and volumes, without regard to any physical properties which they may have. It has various divisions, e.g., plane and solid geometry, analytical or algebraical geometry, descriptive geometry, and the higher geometry. Plane and solid geometry are occupied with the consideration of right lines and plane surfaces, and with the solids generated by them, as well as with the properties of the circle, and, it may be said, the sphere; while the higher geometry considers the conic sections and curved lines generally, and the bodies generated by them. In the higher geometry, immense advances have recently been made through improved methods, the application of modern analysis, and the various calculi in algebraical geometry, the nature of which is explained in the article Co-ordinates (q.v.). Descriptive geometry, a division of the science so named by Monge (q.v.), is properly an extension or general application of the principle of projections (q.v.), its object being to represent on two plane-surfaces the elements and character of any solid figure. It has many practical applications. When one surface penetrates another, for instance, there often result from their intersection curves of double curvature, the description of which is necessary in some of the arts, as in groined vault-work, and in cutting arch-stones, etc., and this is supplied by descriptive geometry.

The history of geometry is full of interest, but no more can be given here than a very bare sketch of it. The name of the science (Gr. and Lat. *geometria*) originally signified the art of measuring land. Herodotus, the earliest authority on the subject, assigns the origin of the art to the necessity of measuring lands in Egypt for the purposes of taxation, in the reign of Sesostris, about 1416–1357 B.C (Hero, book ii., chap. 109). This is probable, not only as resting on such authority, but also because, *à priori*, we should expect the necessity of measuring lands to arise with property in land, and to give birth to the art. Of the state of the science, however, among the Chaldeans and Egyptians, we have no record.

The story of Herodotus is further confirmed by tradition. Proclus, in his commentary on Euclid's *Elements* (b. ii. c. 4), says that the art was brought to Greece from Egypt by Thales, who was himself a great discoverer in geometry. The Greeks at once

took keenly to the study; various disciples of Thales excelled in it, chief among them Pythagoras, who, according to Proclus, first gave geometry the form of a deductive science, besides discovering some of its most important elementary propositions, among others, it is said, the 47th Prop. Euc. b. i. See article PYTHAGORAS for a notice of his other contributions to the science. Pythagoras had illustrious successors: Anaxagoras of Clazomenæ; Ænopidis, the reputed discoverer of Euc. b. I. 12, 23; Briso and Antipho; Hippocrates of Chios, who "doubled the cube," and quadrated the lunula, which bear his name, and is said to have written a treatise on geometry; Zenodorus; Democritus of Abdera; and Theodorus of Cyrene, who is said to have been one of the instructors of Plato, whose name marks an epoch in the history of the science. Over his academy at Athens, Plato placed the celebrated inscription, *Medeis ageometretos eisito* ("Let no one ignorant of geometry enter here"), thus recognizing it as the first of the sciences, and as the proper introduction to the higher philosophy. He is the reputed inventor of the method of geometrical analysis, and of geometrical loci and the conic sections, called in his time the higher geometry. From his academy proceeded many who advanced the science, of whom Proclus mentions thirteen, and more than one of them as having written treatises on the subject, that have been lost. We shall mention but two of these: Eudoxus, who is said to have brought into form and order in a treatise the results of the studies at the academy, and to have invented the doctrine of proportion, as treated in the 5th book of Euclid's *Elements;* and the great Aristotle, who assigned geometry as high a place as Plato did, and who wrote a treatise on the subject, as did at least two of his pupils, Theophrastus and Eudemus, from the latter of whom Proclus took most of his facts. Autolycus, a disciple of this Theophrastus, wrote a treatise on the movable sphere, yet extant; while Aristæus, the reputed instructor of Euclid in geometry, is said to have written five books on the conic sections, and five on solid loci, all of which are lost.

The name of Euclid marks another epoch in the history of geometry, and the chief interest of the vague sketch above given of the labors of his predecessors lies in its demonstrating the great mass of materials from which he constructed his *Elements*—the variety of treatises which prepared the way for that great work whose pre-eminence has now for over 2,000 years been undisputed. In the *Elements*, Euclid collected all the theorems which had been invented by his predecessors in Egypt and Greece, and digested them into fifteen books, demonstrating and arranging the whole in a very accurate and perfect manner. See EUCLID. Next to Euclid, of the ancient writers whose works are extant, must be named Apollonius Pergaeus, who flourished about 230 B.C., and about 100 years later than Euclid, and was called "the great geometrician," on account of his work on the conics, and other ingenious geometrical writings. Much about the same time with Apollonius flourished Archimedes, not less celebrated for his geometrical than for his mechanical inventions. See ARCHIMEDES, and APOLLONIUS OF PERGA. It may be mentioned that Apollonius first gave the names of *ellipse* and *hyperbola* to two of the conic sections, the third of which had previously been called the *parabola* by Archimedes.

For a long period after the time of Archimedes, we find few names of note in connection with geometry. We but mention Nicomedes, Hipparchus, and Theodosius of Tripoli. The Greeks, however, never intermitted their attention to the science; they continued it even after their subjugation by the Romans, and we find them producing many excellent geometers after the translation of the Roman empire, and within our era: Ptolemy (q.v.), who died 147 A.D.; Pappus (q.v.), who lived in the time of Theodosius (379–395 A.D.); Proclus, who lived in the 5th, and Eutocius, in the 6th century. The works of all these writers are still extant. Meantime, the Romans, the dominant race, even in the most flourishing time of the republic, were so ignorant of the science, that, according to Tacitus, they gave the name of mathematicians (q.v.) to those who practiced divination and judicial astrology. As may be supposed, their domination was not favorable to the science, and only one Roman name can be mentioned—viz., Boëthius, who lived towards the close of the 5th c., who attained eminence in geometry; and of his writings, it must be said, as of the Roman literature generally, that they were but compilations and reflections of Greek thought. But if the Roman empire was unfavorable, its downfall, and the consequent inundation of ignorance and barbarism, were still more so. The rise of the Mohammedan power in the 7th c., and the rapid and desolating consequences which followed, further hastened the extinction of the Greek sciences. The time now came when those who devoted themselves to science were everywhere branded as magicians, and exposed to popular fury. It was in these times that, fortunately for civilization, an asylum was found for the spirit of inquiry in Arabia. An acquaintance with the science of the Hindus prepared the Arabians for the reception of the writings of the Greek astronomers and mathematicians; and the dispersion of the scientific coteries of Alexandria gave to Bagdad many preceptors in the learning of the west. In little more than a century after it took place, the Arabians were the most zealous patrons and cultivators of Greek science; from the 9th to the 14th centuries, they produced many astronomers, geometricians, etc.; and through them the mathematical sciences were again restored to Europe towards the close of the 14th c., being first received in Spain and Italy. The revival of ancient literature in Europe, and the discovery of the art of printing about the middle of the 15th c., concurred to diffuse a

knowledge of the science of the Greeks, which came into notice with their general literature; and from this date, many names occur of eminent geometricians. During the 16th c., Euclid was held in such estimation, that no attempts were made to advance the science beyond the point at which he left it. Commentaries and translations of the *Elements* of Euclid were rife; but till the time of Kepler, no attempts were made to improve or extend the methods of geometry. Kepler (q.v.) introduced the principle of infinity into geometry. Next, Descartes, seizing the results of Vieta's discoveries in the use of symbols, invented the new or the analytical algebraical geometry, which vastly extended the domains of the science. It then required but the invention of the calculus to give the science that grand sweep and power which it now possesses. For a notice of some of the more recent improvements in geometrical methods, see TRANSVERSALS, POLARS, PROJECTIONS. The reader will also find a very excellent view of the growth of the science in the introduction to Mr. Pott's *Euclid* (London, 1845); also under the various names of those mentioned in this article, will be found fuller notices of their contributions to the science. No full list can be given of the contributors, but it would be unjust not to refer here to Johann Müller (called Regiomontanus), Copernicus, Tartaglia, Vieta, Galileo, Fermat, Roberval, Pascal, Huyghens, Barrow, Newton, the Gregories, Lagrange, Clairaut, Euler, Robert Simson—whose translation of Euclid may be regarded as the standard text in English—Mathew Stewart, Brook Taylor, Maclaurin, Monge, Poncelet, Carnot, Chasles, and sir William Hamilton of Dublin. See also QUATERNIONS.

GEOPHAGISM, the custom of dirt-eating, indulged in by the lowest order of savages, most particularly in Terra del Fuego. A kind of ferruginous clay is regularly sold for food in certain parts of Bolivia. The practice is usual among the negroes of the West Indies, and to some extent among North American Indians, while Laplanders mix clay with the flour of which they make their bread.

GEOPONEKA, a Greek treatise upon agriculture written in the time of and dedicated to the emperor Constantine, the successor of the first Christian emperor. The work is divided into twenty parts, treating of the cultivation adapted to various soils and crops, and the rural labors suited to the different seasons of the year; with directions for the sowing of the various kinds of corn and pulse; the training of the vine, and the art of wine-making, upon which the author is particularly diffuse. He also treats of olive plantations and oil-making, of orchards and fruit-trees, of evergreens, of kitchen-gardens, and of the insects and reptiles that are injurious to plants. He exemplifies the economy of the poultry-yard, mentions the treatment best adapted for horses, asses, and camels, suggests improvement in the condition of horned cattle, sheep, goats, pigs, etc., and dwells upon the care they require, describes the best method of salting meat; and, lastly, treats of the various kinds of fishes. Every chapter is inscribed with the name of the author from whom it is taken, and the compiler gives at the beginning of the first book a list of his principal authorities, amongst whom were Africanus, Anatolius, Apulius, Damogeron, Democritus, Didymus, Dionysius Uticensis (the translator of Mago, the Carthaginian writer on agriculture), Diophanes, Florentinus, Leontius, Pamphilus, Paxamus, the Quintilii, Varro, and Zoroaster. Other authors in addition to these are quoted. The work is curious, as giving a course of ancient agriculture collected from the best authorities then existing.

GEORGE, a district of the Cape Colony, is separated from that of Zwellendam on the w. by the Gauritz (q.v.). It contains 4,032 sq.m., and about 11,000 inhabitants. It is valuable chiefly for its pasturage and its timber. On its coast is the port of Mossel Bay.

GEORGE I., King of Great Britain, son of Ernst August, elector of Hanover, and of Sophia, a granddaughter of James I. of England, was b. May 28, 1660. According to the theory that the blood of James II. in the direct line was "corrupted," he was the nearest heir to the crown. On the death of Queen Anne, July 31, 1714, he was instantly proclaimed king, and arrived in this country from his electorate of Hanover, at the age of 54. To him this country was to the last a foreign country, for which he had no love, and of the language, feelings, and thought of which he was profoundly ignorant. His affections remained with Hanover, but to Britain his alliances, experience, and fair abilities for business, resolutely exercised, were of considerable value. A king of more brilliant parts might have been an impediment in the way of constitutional government adjusting itself to the habits of domestic peace and order after the dethronement of the Stuarts, whose ruined fortunes excited the pity of the people, and afforded a convenient cry for the minority, that declaimed in private, and wrote songs, and plotted against the imported king, whom they called a "foreign tyrant." Being supported by the whigs, and undisguisedly partial to them, the tories were adverse to him, as well as the Jacobites, and they associated together to bring about a revolution. In Scotland, in 1715, the earl of Mar raised the standard of rebellion: and he had collected about 10,000 men, when he engaged the duke of Argyle with about half that number of men at Sheriffmuir, near Dunblane. It was a drawn battle, the left wing of both armies being victorious; but to the rebels it was not a victory, and it caused delay and checked their progress, and that was equivalent to a defeat, for the Highlanders, seeing little prospect of fighting and plunder, returned home; and in that part of the island the rebellion may be said to have burned out of itself. In England, it did not succeed so well, and it was ended miserably by the unconditional surrender of the insurgents at Preston. For this

outbreak the earl of Derwentwater and viscount Kenmure were beheaded on Tower Hill, several officers were shot, many persons of distinction were attainted, about thirty of the less conspicuous rebels were executed, and above 1,000 were transported to the plantations. The earl of Mar and the pretender both escaped to France.

The next most notable and calamitous event of this reign was the failure of the South Sea company (q.v.). A quarrel with the Spaniards commenced in 1726, which issued in a somewhat unsuccessful expedition of admiral Hosier to their American possessions, and a fruitless attempt on Gibraltar (q.v.) by the Spaniards. In 1727, George I., who had, amid the splendors of British royalty, sighed for his fatherland and his family, set out for Hanover, and died of apoplexy on his way to visit his brother, who was bishop of Osnabrück, on the night of the 10th or the morning of the 11th of June. His life was not a happy one. His wife, Sophia Dorothea of Zell, to whom he was untrue, had solaced herself by yielding to the attentions of Philip von Koningsmark. On Sunday the 1st July 1694, the latter disappeared forever in a mysterious way, and on the 28th Dec. Sophia was divorced. The remaining 32 years of her life were spent as a prisoner in the fortress of Ahlden, where she died at the age of 60. There are clear glimpses of George I. in Carlyle's *Life of Frederick the Great.* Carlyle commends his talent for silence, and thinks him, in spite of appearances, a man of more human faculty, "chiefly of an inarticulate kind," than he generally gets credit for.

GEORGE II. succeeded his father as king of England in the 45th year of his age. He was b. at Hanover on Oct. 30 1683, and married Carolina Wilhelmina, daughter of the markgraf of Anspach. She is said to have been a woman of uncommon attainments in literature, theology, and politics, and her death in 1737 was reckoned a public loss. The king himself did not aspire to a code of morals different from his fathers, nor to any intellectual accomplishments except those of a soldier. He was present at the battle of Dettingen in 1743, and with the assistance of the earl of Stair he gained it: the French being entirely defeated, and very efficient service rendered to Maria Theresa of Hungary, who had besought it to prevent the partition of her dominions. His second son, the duke of Cumberland, was not so fortunate, for the English forces under him were defeated with great loss in 1745 at Fontenoy by the French under the famous marshal Saxe. In the same year (1745) prince Charles Stuart, son of the old pretender, landed in Scotland with seven officers, and arms for 2,000 men. After some transient successes, he was completely defeated at Culloden, April 16, 1746, and what is known as the *Second Rebellion* was brought to an end. (See STUART, CHARLES EDWARD.) The duke of Cumberland, whose barbarities in the suppression of the insurrection earned him the name of the "bloody butcher," returned to the command of the English forces on the continent, and was repeatedly beaten by marshal Saxe and the French; much that Marlborough had gained being lost. In india, colonel, afterwards lord Clive, gained various victories, the chief of them being the victory at Plassey in 1756, which laid the foundations of the British East Indian empire; and during the next three years the British dominion in North America was extended and strengthened by the victory of Wolfe on the heights of Abraham, and by the subsequent surrender of Quebec. British allied troops contributed to the Hanoverian victory at Minden in 1789. George died Oct. 25, 1760, in the 77th year of his age, and the 34th of his reign. Generally, the reign of George II. was a prosperous one: according to Hallam, "the most prosperous period that England had ever known;" and it was this, not less from the acquisition of new territory than from the conquest of new fields of thought effected by Pope, Hume, Samuel Johnson, Fielding, Smollett, Reynolds, Hogarth, and many others.

GEORGE III., son of Frederick Lewis, prince of Wales, succeeded his grandfather, George II. He was born June 4, 1738, and died at Windsor castle Jan. 29, 1820, in the 60th year of his reign, which was eventful as well as long. On Sept. 8, 1761, he married the princess Charlotte Sophia, daughter of Charles duke of Mecklenburg-Strelitz, and was by her the father of 15 children. His intellect was not of the strongest, but, like his two predecessors, he had firmness of purpose, and, in addition, a conscientiousness and sense of decorum unknown to them, while both friends and enemies could rely upon him—the one for favors, and the other for the reverse. His mind gave way several times—in 1764, in 1788, in 1801, in 1804; and in 1810, when the British were fighting behind the lines of Torres Vedras, his final insanity supervened. He had an abundance of cares, like most sovereigns. The *Letters of Junius* and the invectives of Wilkes annoyed him; so did the proposals to emancipate the Roman Catholics, and the terrible French revolution of 1789. His life was attempted by the maniacs Margaret Nicolson and a man named Hatfield. The marriages of two of his brothers with the widows of subjects displeased him, and led to the passing of the royal marriage bill, 12 Geo. III. c. 11, prohibiting the members of the royal family from contracting marriage without the consent of the king, if under 25 years of age, and the consent of parliament if above that age; and afterwards the undoubted debts and dissipation of his eldest son, who became George IV., his hardly doubtful marriage with Mrs. Fitzherbert, the Roman Catholic widow of two husbands, and the scandals of his public marriage with his cousin, Caroline of Brunswick, must have led the "good old king" to reflect that not even a "marriage-bill" could cure all the domestic miseries of monarchs. Nor were matters of national excitement and magnitude awanting. A bill, imposing certain

stamp-duties upon the American colonies, which had been resolved to be inexpedient in 1764, was passed in Mar., 1765, and repealed in 1766 by the marquis of Rockingham's ministry; and in 1767, the chancellor of the exchequer, Mr. Townsend, brought forward a plan for the taxation of these colonies, which led to their revolt, the colonists objecting to be taxed by a parliament in which they were not represented. In 1770, lord North, the premier, brought in a bill for the repeal of all the recently imposed American duties, except the duty on tea, which was retained, to assert the English right to impose taxes on these colonies. In Dec., 1773, "Boston harbor is black with unexpected tea," cargoes of it being wantonly destroyed by the colonists; and on April 19, 1775, hostilities commenced with the undecisive battle of Lexington, which on June 16 was followed by that of Bunker's Hill, which was a victory to the colonists, and helped to give them boldness to renounce the dominion of Great Britain, and publish the declaration of independence on July 4, 1776. George Washington, a col. of militia, who had been appointed general of the insurgent colonists, took possession of Boston in that year, having compelled gen. Howe and the British troops to retire, and next year he gained an important advantage by the capture of Burgoyne's army of 10,000 fine troops, British and German. The French, Spanish, and Dutch all threw their weight into the American scale, and the checkered and disastrous struggle ended in America by the surrender of lord Cornwallis, with a British army of 6,000, to Washington and the marquis de la Fayette. The French suffered at sea by the gallantry of the British under Byron, Hood, and Rodney, this last having, in 1782, in the West Indies, obtained over them a naval victory by the hitherto untried method of breaking the enemy's line. In that year, also, gen. Elliott repulsed the grand attack of the French and Spaniards, and put an end to their chances of success in the obdurate siege of Gibraltar. At Versailles, on Sept. 3, 1783, a peace was concluded with France and Spain, in which the independence of the American states was recognized, not a little to the satisfaction of many of the English at home, who, besides being tired of the struggle, had throughout sympathized with the American colonists, whose cause, originally good, had had its merits kept before the public mind by the elequence of Chatham, Fox, and Burke, three of the greatest orators of all time.

Meanwhile, the British rule in India was consolidated, and this was effected in no insignificant degree under the governor-generalship of Warren Hastings, a most able but somewhat unscrupulous man. His trial for misrule and oppression, famous for the eloquent accusations of Burke snd Sheridan, began in 1786, and was protracted for 9 years. Wars with Hyder Ali and his son Tippoo Saib were ended by the storming of Seringapatam in 1799.

The after-swell of the French revolution broke over all the continent of Europe in wave after wave of war. The aversion of Britain to the insane democracy of France was not concealed, and in 1793, a few days after the execution of their king, the French declared war against Britain. In the confused warfare that followed, the English under lord Howe, in 1794, defeated the French fleet in the channel; under sir John Jervis they defeated the Spanish fleet off cape St. Vincent in 1797; and also in that year, under lord Duncan, they defeated the Dutch off Camperdown; and in 1798 Nelson was victorious on the Nile over the French fleet that had conveyed Napoleon Bonaparte and his troops to Egypt. In 1801, he bombarded Copenhagen, and partially destroyed the Danish fleet; and the forces under sir Ralph Abercromby—who was mortally wounded —gained the victory of Alexandria over the troops which Napoleon had left to menace the power of Britain in the east. On Mar. 25, 1802, the treaty of peace of Amiens was signed, but, within a year, hostilities were renewed. In 1803, Hanover was occupied by the French. On Oct. 21, 1805, Nelson lost his life, and gained his greatest victory of Trafalgar over the French and Spanish fleets. Napoleon's splendid victory of Austerlitz over the Austrians and Russians, Dec., 1805, was survived only a few weeks by the great statesman Pitt, whose breaking heart and constitution could not sustain the shock of this last disappointment. Napoleon's Berlin decree of 1806, and his Milan decree of 1807, declaring the British dominions in a state of blockade on purpose to destroy British commerce, were not supported by a sufficient navy to carry them into execution by capturing vessels trading with Britain; but they did no inconsiderable damage. In 1808, sir Arthur Wellesley landed in Portugal, and defeated the French at Vimieira; but the advantage of this victory was thrown away in the convention of Cintra. The retreat, four months after, to Corunna of the English army under sir John Moore, from overwhelming odds, and its safe embarkation in Jan., 1809, after the repulse of Marshal Soult, has secured a reputation for the able and distinguished general who fell there, hardly inferior to that of those who have died in the moment of victory. In April of that year, sir Arthur returned to the command in the peninsula, and after conquering at Talavera on July 8, wearing out the powers of the assailing French behind the lines of Torres Vedras during the last months of 1810, and conquering at Fuentes d'Onoro in 1811, at Salamanca in 1812, at Vittoria in 1813 (as lord Wellington), and in other battles and sieges, he drove the French out of the peninsula. The struggle was terminated on the eventful field of Waterloo (q.v.), June 18, 1815.

On Jan. 1, 1801, Ireland was united to Great Britain, and its separate legislation was abolished. During this reign many Scotchmen had forced their way to the first places in the state; all the Jacobite feelings had died out; and the union had become not a

legislative one merely, but a union of society, literature, thought, and enterprise. The most original and vigorous thought of this period found its expression in poetry, and among its great poets, the most noteworthy are Byron, Coleridge, Wordsworth, and Walter Scott, the last of whom is also at the head of all the writers of prose-fiction. In spite of the depressing effects of war, commerce greatly increased during the 60 years of this reign; and the revenue, which at the beginning of it was under nine millions, had, during the years of the French war, been increased more than sevenfold, thus showing, though by an undesirable method, the vast increase of the resources of the country. Chemistry and the steam-engine were beginning to alter the face of society. Among legislative reforms, the most conspicuous was the abolition of the punishment of death for minor crimes, and generally the statute-book, which had greatly increased, became more and more favorable to individual liberty.

GEORGE IV. became king of Great Britain on his father's death. He had been virtual sovereign during the long period of his father's last insanity, as prince regent. He was born on Aug. 12, 1762, and died on June 26, 1830. That he should have lived so long as 67 years is not the least notable circumstance connected with a life that has supplied as much material for scandal as any in English history. George IV. had considerable intellectual ability and address, could tell stories well, and enjoyed every day without thinking of the next. His personal attractions, and his position, together, led many in his lifetime to style him, not without sincerity, "the first gentleman of Europe;" but the decay of king-worshp, and the growth of morality, have not allowed that to continue to be the opinion of his countrymen. His frailties, and those of his royal namesakes, have been mercilessly exposed by Thackeray in his *Four Georges* (1861). Unfortunately for their memory, no man of Thackery's abilities has set himself to look for their virtues and their good deeds to England—which were not few—and for which they have earned the gratitude of patriots, not mere blind worshippers of royalty.

The marriage of George IV. was specially unfortunate. He entered into it on April 8, 1794, with his cousin Caroline Amelia Elizabeth, second daughter of the duke of Brunswick, under the pressure of debt, and of his father, and their conjugal happiness, if it ever existed, did not last many weeks. The princess Charlotte Augusta was born of the marriage on Jan. 7, 1796, and shortly after, her parents separated, having ceased to speak to each other months before. See CAROLINE. The princess Charlotte had married prince Leopold, afterwards king of Belgium, and she died in childbed on Nov. 6, 1817, greatly to the grief of the whole nation.

Royal visits to Scotland and Ireland; the aid rendered to the Greeks by the British fleet in the battle of Navarino (1827), which secured the independence of Greece; and the passing (1829) of the Roman Catholic relief bill (q.v.), (so odious to his father), are the most notable incidents of this king's reign. He was succeeded by his brother William, duke of Clarence, who had entered the navy in his youth.

GEORGE I. (CHRISTIAN WILLIAM FERDINAND ADOLPHUS GEORGE), King of Greece, second son of the king of Denmark, and brother of the princess of Wales, b. 1845, served for some time in the Danish navy. When, in 1863, Otho I., king of Greece, resigned his crown, the government, after vainly offering the vacant throne to prince Alfred of England and duke Ernest of Saxe-Coburgh Gotha, eventually chose prince Christian, who with the concurrence of his own family and the consent of the great powers, accepted it, and ascended the throne of Greece as king George I. He was married at St. Petersburg to the princess Olga, daughter of the grand duke Constantine, Oct. 27, 1867. The princess Olga was born Sept. 3, 1851.

GEORGE V. 1819–78; last king of Hanover; son of Ernest Augustus and of a sister of queen Louisa of Prussia. When he ascended the throne in 1851, on the death of his father, he was afflicted with blindness. His policy was unfortunate, and in 1866 Hanover became a part of the German confederation. King George fled to Vienna where he continued to agitate against Prussia. In 1868 he mediatized his kingdom for the sum of 16,000,000 thalers, but his enemity to Prussia declared itself so strongly that he was threatened with non-payment of the sum agreed upon.

GEORGE, Prince of Denmark, 1653–1708; second son of Frederick III. He fought in person against Charles XI. of Sweden. In 1683 he married princess Anne the second daughter of James II. of England, by whom he had 17 children, all of whom died before their mother became queen of England. Prince George was devoid of talent and ambition, but was brave and humane. Through his wife's influence he deserted James in the hour of need. After the triumph of the prince of Orange, prince George was naturalized and created duke of Cumberland. He was present at the battle of the Boyne, and when his wife ascended the throne he was created lord high admiral.

GEORGE (the Bearded), duke of Saxony, eldest son of Albert (the Brave), the founder of the Ducal or Albertinian Saxon line, was born in 1471. He early distributed a strong desire for the acquisition of religious knowledge, and in 1484 was sent to Meissen to pursue his studies, with a view to his entering the church. On the death of his father in 1500, George succeeded to the whole dukedom, consisting of the half of Thuringia and Meissen, with the exception of the lately acquired country of Friesland, which fell to his younger brother Henry, who, however, soon after exchanged it with George for

Freiberg and Wolkenstein. Though George and William, duke of lower Bavaria, were the two pillars of Catholicism in Germany, yet the former did not appear to be much displeased with the proceedings of Luther previous to the Leipsic controversy; on the contrary, they were at one in regard to the many abuses which had crept into the church, but George wished to remedy them through papal edicts, or the general decisions of a general council. The ill-feeling between George and Luther commenced during the Leipsic controversy, and arose from a misapprehension of Luther's doctrine of justification by faith; it necessarily increased in strength in one who was so remarkable for obstinacy, especially as it was carefully fostered by John Eck and other of Luther's enemies. Yet when the emperor seemed likely to violate his safe conduct given to Luther, George strongly protested against such a breach of good faith. The later years of his reign were embittered by a succession of domestic calamities: first his wife died, then all his children in succession, and thus his brother, Henry of Freiberg, became heir-apparent. Henry was a zealous Protestant, and such was George's antipathy to being succeeded by one of that religion, that he attempted to break the line of succession, but did not live long enough to accomplish his purpose. He died in 1530, and was succeeded by Henry.

GEORGE, Duke of Saxony, the second son of king John, b. 1832. He entered the artillery service, and gave evidence of his bravery in the campaign of 1866, when he commanded a brigade of cavalry. At the outbreak of the Franco-German war in 1870 he was in command of the first division of the Saxon army corps, but after the battle of Metz, he commanded the fourth army corps, which he led at the battle of Sedan, and during the siege of Paris. At the close of the war he retained his command.

GEORGE, known as Pisides or Pisida, a Byzantine writer of the 7th c., was, as his surname implies, a native of Pisidia; but of his personal history nothing is known except that he had been ordained a deacon, and that he held, either simultaneously or successively, the offices of "chartophylax," "scenophylax," and "referendarius" in the "Great Church" (that of St. Sophia) at Constantinople. He is also believed to have accompanied the first expedition (622) of the emperor Heraclius against the Persians; at all events, his earliest work, consisting of 1098 iambic trimeter verses, is devoted to such a description of that campaign, as could hardly have come from any other than an eye-witness. This composition was followed in 641 by verses containing the details of a futile attack on Constantinople, made by the Avari in 626, while the emperor was absent, and the Persian army in occupation of Chaldecon; and by a general survey of the exploits, both at home and abroad, of Heraclius down to the final overthrow of Chosroes in 627, which is believed to have been written before the end of 628. In addition to these three works, which have been edited by Bekker, we have, from the pen of George of Pisidia, a poem upon the creation of the world, containing in its present form 1910 trimeter iambic verses; a treatise on the validity of life in 262 verses; a controversial composition against Severus of Antioch, in 731 verses; two short poems upon the resurrection of Christ and upon the temple of the Virgin at Blachernae, respectively, and a prose encomium upon Anastasius the martyr. George of Pisidia is known to have written several other works, which, however, are no longer extant; and there is no sufficient reason for assigning to him the compilation of the *Chronicon Paschale* or the astronomical poem entitled *Empedoclis Sphæra*. As a versifier, George is correct and even elegant; as a chronicler of contemporary events, he is exceedingly useful; but the modern verdict on his merits as a poet has not confirmed that of those later Byzantine writers whose enthusiastic admiration led them to compare him with and even refer him to Euripides. Recent criticism is unanimous in characterizing his composition as artificial and almost uniformly dull.

GEORGE of CAPPADOCIA, from 356 to 361 Arian archbishop of Alexandria. He was a native of Epiphania, in Cilicia; but universal tradition makes him a Cappadocian. Gregory Nazianzen tells us that his father was a fuller, and that he himself soon became notorious as a parasite of so mean a type that he would "sell himself for a cake." By his powers of insinuation he succeeded in obtaining a lucrative contract for supplying bacon to the army, but fulfilled its terms so ill that he was soon compelled to abscond, after he had with diffiulty escaped death at the hands of the indignant soldiers. After many wanderings, in the course of which he seems to have lived some time at Constantinople and to have amassed a considerable fortune as receiver of taxes, he ultimately reached Alexandria. It is not known when or how he obtained ecclesiastical orders; but after Athanasius had been banished in 356, George was promoted by the influence of the prevalent Arian faction to the vacant see. His persecutions and oppressions of the orthodox ultimately raised a rebellion which compelled him to flee for his life; but his authority was restored, although with difficulty, by a military demonstration. Untaught by experience, he resumed his course of selfish tyranny over Christians and heathen alike, and raised the irritation of the populace to such a pitch that, within a few days after the accession of Julian, they arose *en masse*, dragged him out of prison, where he had been placed by the magistrates for safety, paraded him with every indignity through the streets on a camel, burnt his dead body, and cast the ashes into the sea. With much that was sordid and brutal in his character, George combined a highly cultivated literary taste, and in the course of his checquered career he had found the means

of collecting a splendid library, which Julian ordered to be carefully preserved and conveyed to Antioch for his own use.

GEORGE, ENOCH, 1767-1828; b. Va.; a minister and bishop of the Methodist Episcopal church. He began to preach in North Carolina, and made extensive circuits in that state and Virginia, South Carolina, and Georgia, until from physical inability he was compelled to retire. He resumed his work in 1799, and in 1800 took charge of a district extending from the Alleghanies to Chesapeake bay. Again the failure of his health forced him to retire, and again he resumed work. He was chosen bishop in 1816, and filled the office until his death.

GEORGE (LAKE), called also Horicon, a picturesque sheet of water, remarkable for its transparency and for the beauty of the scenery on its shores, lies in the state of New York, and measures 34 m. by 3. It discharges its waters into lake Champlain, thus forming a part of the grand system of the St. Lawrence. It is, in some places, 400 ft. deep. It possesses some historical interest in connection with the North American wars between England and France.

GEORGE (LAKE), (*ante*), in e. New York near the border of Vermont; about 36 m. long from s. to n., and from 1 to 4 m. wide; generally shallow, but in some places very deep. It merges into lake Champlain on the n. Lake George is one of the most beautiful of the many lakes of the n. Its waters are singularly clear; it is dotted with charming islands, and the scenery of its banks is in the highest degree picturesque. Great historical interest attaches to it in events connected with the old French war and the war of the revolution. The ruins of the famous fort Ticonderoga, taken by Ethan Allen "in the name of Almighty God and the continental congress," are on the stream connecting with two lakes. Lake George was discovered early in the 17th c. by the French missionaries, and father Jogues called it St. Sacrament lake because he arrived there on Corpus Christi day, May 27, 1646. The English named it after George III.

GEORGE (ST.), one of the Bermudas, is strongly fortified, and forms the principal depot in the group for military purposes. On the south coast is a town of its own name, which has a large harbor of considerable strength.

GEORGE, SAINT, a saint, venerated both in the eastern and western churches, held in especial veneration as the patron of chivalry, and adopted as the tutelary saint of England. His origin is extremely obscure, and the very oldest accounts of him which are extant, contain a strange admixture of history and legend. He is honored both in the east and the west as a martyr, and the Greek acts of his martyrdom fix the date of his death as the persecution under Diocletian; but these acts are, by the confession even of Roman Catholic hagiologists, undoubtedly spurious. On the other hand, it is asserted (see Gibbons's *Decline and Fall*, ii. 323) that the canonization of George is one of the many errors which Protestant historians freely impute to the Roman calendar, and that the George who is thus reputed a saint and martyr is no other than the turbulent and unscrupulous Arian partisan, George of Cappadocia, whom his Arian followers revered as a saint, and imposed as such upon the credulity of their Catholic countrymen. It must be confessed, however, that the best modern authorities, Catholic and Protestant, agree in admitting the great improbability of this allegation. Heylin is of one mind in this matter with the Jesuit Papebroch, and Dean Milman adopts the arguments and agrees in the opinion of the Roman Catholic bishop Milner. The truth is, that whatever is to be said of the early accounts of the martyrdom of George, the fact of his being honored as a martyr by the Catholic church, of churches being dedicated to him, and of the Hellespont being called "St. George's arm," is traced by Papebroch, by Milner, and by other writers to so early a date, and brought so immediately into contact with the times of the angry conflicts in which George of Cappadocia figured as an Arian leader, that it would be just as reasonable to believe that the Catholics of England at the present day would accept lord George Gordon as a Catholic saint, as to suppose that the Catholics of the East—while the tomb of Athanasias was hardly closed upon his honored relics—would accept as a sainted martyr his cruel and unscrupulous persecutor. Indeed it cannot be doubted that the St. George of the eastern church is a real personage, and of an earlier date than George of Cappadocia—very probably of the date to which these acts, though otherwise false, assign him. The legend of his conflict with the dragon arose most probably out of a symbolical or allegorical representation of his contest with the pagan persecutor. As in this ancient legend St. George appears as a soldier, he was early regarded as one of the patrons of the military profession. Under this title, he was honored in France as early as the 6th c.; but it was not until after the crusaders, who ascribed their success at the siege of Antioch to his intercession, returned to Europe from the holy war, that the religious honor paid to him reached its full development. He was selected as the patron saint of the republic of Genoa and also of England. At the council of Oxford, in 1222, his feast was ordered to be kept as a national festival. In 1330, he was made the patron of the order of the garter by Edward III.; and even since the reformation, the ancient sentiment is still popularly maintained.

GEORGE, ST., BANNER OF, white, with a red cross. According to sir N. H. Nicolas the cross of St. George was worn as a badge over the armor by every English sold-

"in the 14th and subsequent centuries, even if the custom did not prevail at a much earlier period," to indicate that he was in the service of the crown. On the invasion of Scotland by Richard II. in 1386, it was ordained "That everi man of what estate, condicion, or nation they be of, so that he be of oure partie, bere a signe of the armes of Saint George, large bothe before and behynde, upon parell that yf he be slayne or wounded to deth, he that hath so doon to hym shall not be putte to deth for defaulte of the crosse that he lacketh. And that non enemy do bere the same token or crosse of St. George, nothwithstandyng if he be prisoner, upon payne of deth." A similar ordinance was adopted by Henry V. for the government of his army in France.

GEORGE, THE, the badge of the order of the garter (q.v), exhibiting the figure of St. George on horseback piercing the falling dragon, which lies on a mount.

GEORGE, of TREBIZOND, 1396–1486; one of the distinguished writers in the great controversy between Aristotelianism and Platonism in the 15th c., was b. at Chandace in the island of Crete. He received his cognomen apparently from the fact that his ancestors had come from Trebizond. He came to Italy and settled as teacher of philosophy and rhetoric at Venice. His reputation as a teacher and as translator of Aristotle was very great, and he was selected as secretary by pope Nicholas V., an ardent Aristotelian. The needless bitterness of his attacks upon Plato, which drew forth a powerful response from Bessarion, and the manifestly hurried and inaccurate character of his translations, both of Plato and Aristotle, combined to ruin his fame as a scholar, and to endanger his position as teacher of philosophy The indignation against him, on account of his first-named work, was so great that he would probably have been compelled to leave Italy had not Alphonso V. given him protection at the court of Naples. He died in Rome. Many of his translations of Aristotelian treatises are to be found in the older editions of Aristotle.

GEORGES, MARGUERITE JOSEPHINE, 1787–1867; a French actress of great beauty and genius, who appeared in 1802 as *Clytemmnestra.* She played in Dresden before Napoleon and Alexander I, of Russia. She was patronized by Napoleon and Hortense, who introduced her at the Theater Français in 1813. Talma was one of her teachers. For many years she was one of the reigning favorites in the principal European cities. Her most acceptable representations were *Semiramis, Merope, Dido, Agrippina, Lucrezia Borgia, Mary Tudor* and *Catherine de Medici.* When she retired from the stage she was so poor that she was compelled to teach to earn a living.

GEORGE'S CHANNEL, ST. is the name applied to the s. portion of that arm of the Atlantic which separates Ireland from the United Kingdom. A line, extending from Holyhead in Wales to Dublin, would form the northern limit of this channel; and a similar line from St. David's Head to Wexford, would form its southern limit. At its northern extremity it is 64 m. in width, and at its southern it is about 62 m. wide; its length, from n.e. to s.w., is about 100 miles.

GEORGETOWN, a co. in e. South Carolina on the sea coast between the Santee and the Great Pedee rivers; 800 sq.m., pop. '80, 19,613—16,152 colored. It has a level and, in some places, a swampy surface. The productions are rice, corn, and cotton. Co. seat, Georgetown.

GEORGETOWN, a city and port of entry of North America, in the district of Columbia, is situated on a range of hills, the highest of which are denominated the *Heights,* on the left bank of the Potomac, 2 m. n.w. of Washington (q.v.). From the Heights, which are occupied by elegant villas, a magnificent view of the cities of Georgetown and Washington, and of the surrounding country is obtained. Georgetown is quiet and antiquated, and has a reputation for its literary advantages and for its refined society. Its principal institutions are the Georgetown college, under the management of the Jesuits, and the convent of Visitation Nuns—attached to which is an academy for females with about 100 pupils. Here the Alexandria branch of the Chesapeake and Ohio canal is carried across the Potomac by means of an enormous viaduct 1446 ft. long, and 36 ft. above the ordinary level of the water. As it is the only port in the district of Columbia, and situated at the head of the navigation of the Potomac, 125 m. from its mouth, its foreign commerce and coasting trade are important. It keeps 50 mills in operation to supply its trade in flour. It is one of the greatest markets in the United States for shad and herrings, of which vast quantities are caught in the Potomac, and brought here for barrelling. Pop. '70, 11,384.

GEORGETOWN, a t. in Scott co., Ky., on the Cincinnati Southern railroad, 13 m. n. of Lexington, pop., 1570. It is the seat of Georgetown (Baptist) college, founded in 1838. It possesses banks, newspapers, manufacturing establishments, and a female seminary.

GEORGETOWN, the seat of justice in the co. of the same name in South Carolina, on Winyaw bay, near the mouth of Waccamaw river, 14 m. from the sea and 50 m. n.e. of Charleston; pop, 2,557. Its principal trade is in rice, pine timber, and turpentine.

GEORGETOWN (Dutch, *Stabroek*), the capital of British Guiana, is situated at the mouth and on the right or eastern shore of the river Demerara, in latitude 6° 49′ 20″ n., and long. 58° 11′ 30″ west. It is handsomely built, and consists of spacious, clean

streets, intersecting at right angles, and composed of neat wooden houses, which have open verandas in front, and are embosomed in trees, of which the cabbage-palm, the cocoa-nut, and the orange tree are the chief. Some of the streets are traversed by canals, communicating with each other and with the river. Of the public buildings, the town-hall, an elegant structure, with marble-paved galleries resting on cast-iron columns, the Episcopal cathedral, and the Colonial hospital, are the principal. There are also a mariner's hospital, numerous churches and schools, astronomical and botanical societies, barracks, theaters, and a market-place surrounded by elegant and well-stocked shops. Georgetown, owing to the low and swampy character of the district is unhealthy. Yellow and intermittent fevers, diarrhœa, and dysentery, are local diseases. The chief exports of Georgetown are sugar, coffee, and rum; and its annual trade employs about 600 vessels of 102,000 tons burden. A new almshouse for the poor has been erected, and all the settled parts of the colony connected with Georgetown by telegraph, Pop. '74, 36,562, of which about 30,000 are negroes and people of color.

GEORGIA, an Atlantic state of the American union, and one of the 13 original states, extends in lat. from 30° 21′ to 35° n., and in long. from 80° 48′ to 85° 40′ west. It is bounded on the n. and n.e. by the states of Tennessee, North Carolina, and South Carolina, on the w. by Alabama, and on the s. by Florida. Its extreme length from n. to s., is 320 m.; and its greatest breadth, from e. to w., is 254 miles. Its area is 58,000 sq. miles. According to the census of the United States taken in 1870, Georgia contained 1,184,109 inhabitants, of whom 638,926 were whites, and 545,142 colored. In 1800 its population was 162,686. In 1870 the taxation amounted to 945,394 dollars; the value of assessed property, real and personal, was 227,219,519 dollars, and the public indebtedness was 21,753,712 dollars. It sends 9 members to the federal congress, in addition to the 2 senators to which every state is entitled. Georgia presents every variety of surface, rising from low alluvial lands and swamps along the shore, through an undulating and rough hilly country to the Blue Ridge mountains, in the n. and n.w. of the state. The chief rivers are the Savannah, which forms the n.e. boundary of the state, and the Chattahoochee, which forms a great portion of its s.w. boundary. The course of all the important rivers is toward the s. and south east. Only about a fifth of the entire area of the state is under cultivation; but owing to the diversity of climate and soil, the productions are wonderful in their variety. The islands that fringe the coast are fertile in cotton of a superior quality; the bottom lands of the great rivers produce rice, cotton, Indian corn, and sugar; further west are the "pine barrens," valuable for their timber, and easily cultivable; the central region consists of a loamy soil, once productive, but now impoverished; and the north, the Cherokee country, contains lands which, although long worked by the Indians, still produce from 50 to 76 bushels of grain to the acre. In 1870, Georgia was second to Mississippi alone in producing cotton. Gold, though now in very small quantity, is found; silver, copper, iron, lead, marble, and precious stones also occur. In Jan., 1875, 2,279 m. of railway were open for traffic. The state is divided into 136 counties, and the chief towns are Atlanta (the capital), Savannah, Macon, and Augusta. It was colonized in 1733. Having joined in the great revolt which occasioned the American war and shared the defeat, it was readmitted into the union in 1870. There are in the state 33 colleges, with an average of 3,500 students; and in 1870 the total number of educational establishments was 1880, with 66,150 scholars. Immigration is encouraged.

GEORGIA (*ante*); so named in honor of George II.; one of the 13 original states of the American union, lying on the Atlantic between 30½° and 32° n., and running inland up to 35° n., and between 31° and 35½° w. It has the ocean on the e., South Carolina on the n.e., North Carolina and Tennessee on the n., Alabama on the w., and Florida on the s.; length 320 m.; width 245 m.; area 58,000 sq. miles. Nearly all the sea-coast is low and swampy, and indented by sounds, among which are Altamaha, Cumberland, Doboy, Ossabaw, Sapello, Warsaw, and Sts. Andrew, Catherine, and Simon. Between these sounds and the ocean are the large islands of Ossabaw, St. Catherine's, Sapello, St. Simon's, Jykill, and Cumberland, which are very fertile, and produce, among other things, the valuable sea-island cotton. Some 20 m. from the ocean the land rises abruptly some 75 ft., and at nearly the same distance inland another elevation occurs of equal height, and from it table-land gradually rises until, towards the center of the state, the level is 575 ft. above the sea. Further to the n.w. are gradually increasing hills, in almost parallel ranges, for a distance of some 150 m., finally reaching 2,000 to 4,000 ft. above sea-level. On the east is a range of the Appalachian mountains, and beyond it an undulating surface of hills and valleys extends to the foot of the Blue Ridge, which covers the n.w. portion of the state and rises from 2,000 to 4,000 ft., forming the water-shed of streams flowing to the Atlantic, the Ohio, and the gulf of Mexico. The Savannah is the largest river of Georgia, and is about 450 m. in length, navigable for large vessels to Savannah, 18 m. from the sea, and for steamboats, to Augusta, 230 m. further, whence small steamboats proceed by a canal around the falls, about 150 m. more. This river forms the boundary between Georgia and South Carolina. The Chattahoochee, which is the Alabama boundary, is nearly 600 m. in length, and navigable for 300 m. from the gulf to the falls at Columbus. Flint river, a branch of the Chattahoochee, is navigable to Albany, over 100 m. from its mouth. The Altamaha,

falling into the Atlantic near the ocean boundary of Georgia, is navigable for ships to Darien, and for steamboats to its source, and by both branches, the Ocmulgee to Macon, and the Oconee to Milledgeville. The Ogeechee, the Altamaha, and the Savannah and its southern branch, the Cannouchee, admit of sloop navigation. The Santilla and St. Mary's (the latter forming part of the Florida boundary) are also navigable for small craft. Other rivers of Georgia are the Withlacoochee and Allapaha, which unite in Florida and form the Suwanee: the Etowah and Oostenaula, which at Rome form the Coosa; the Tallapoosa, the Tacoah, and the Natley.

In Oct., 1828, a negro slave discovered in the sands of Bear creek, in White county, some grains of gold, but so fine that no attention was given to them until the same negro found in the Nacoochee river sands a nugget worth several thousand dollars. This started a gold-hunting furor. A tradition existed among the frontier settlers of the Cherokee country, which covered about one third of Georgia and part of the adjoining mountain district of western North Carolina, that there was gold there, and that the Indians knew where, for they had sometimes used it for bullets, but were prohibited by Indian laws and a death penalty from discovering the much coveted metal to the white men. The U. S. government was forced to remove the Indians at national expense for the benefit of Georgia, which seized upon the whole Cherokee country and divided it up by lottery in 1833, among all the "free white male population of the state"—the supposed mineral lands in 40-acre lots, and the farming lands in 160-acre lots. As it was impossible to tell at that time what part of the territory contained gold, it was an arbitrary division upon guess-work. On many of the tracts sold as "gold lots" by men who drew prizes in that lottery, and which are even now sometimes sold to strangers in other states, gold has never been found. On the other hand, gold is often found upon farming lands in several counties where it was not at first supposed to exist. White county has been one of the noted mining regions of Georgia for more than 50 years. The work has been done mostly upon a limited scale by citizens of small means, and only with the rudest kind of machinery. Lately, work has been prosecuted in better order by men who understand the business of mining and reducing quartz rock in good stamp mills. The noted Louderville mines and mills are in the southwesterly portion of White county. The next great find of gold after the Nacoochee valley discovery, was on the Chestatee river, at a place that soon became famous as "Leather's Ford," 50 m. from Atlanta. The discovery of gold here was the cause of the historical "intrusion" into the Cherokee country in 1829–30, to prevent which, U. S. troops were sent there; but they created an excitement, brought in ten gold-hunters for every one that they kept out. Thousands of adventurers rushed thither and held their ground in spite of the efforts of the troops to drive them away. Miners' camps were established at "Knucklesville," now called Auroria, and at Dahlonega, which have seldom been equaled in California or Colorado. This was the beginning (1829) of Georgia gold mining, or rather gold finding, and from this all of the present immense mining interest of the United States has grown up. A branch mint was established at Charlotteville, N. C., and another at Dahlonega, at vast expense, but without profit to the U. S. treasury. The chief deposits are in a belt 15 to 20 m. wide, extending across the state on the eastern slope of the Alleghanies. The production from 1829 to 1849 is estimated at 1,000,000 ounces. The amount of gold deposited in the U. S. mint and branches, from Georgia, to June 30, 1873, was $7,267,784. Since the discovery of gold in California the annual production has fallen to a comparatively low figure. The mint erected by the United States, soon after the first discovery of gold in Georgia, at an expense of $80.000, was, after the close of the rebellion, given to the state to be used for an agricultural school, and its costly machinery sold for less than old iron. A very little silver is found in the state, and iron is abundant. In one place a whole mountain of fossiliferous iron ore is parallel with and less than a mile distant from Lookout mountain, in which are extensive beds of coal. There is coal in many other places; copper in one place, and the usual minor minerals, such as antimony, zinc, manganese, etc,, but none are extensively worked. There are also deposits of marble, gypsum, talc, asbestos, soapstone, slate, tripoli, petroleum, barytes, hydraulic cement, quartz crystals, beryl, garnet, agate, and so-called diamonds. There are chalybeate springs in the n. part, and sulphurous springs in the center of the state.

The principal fossils are, remains of the mastodon, the megatherium, the myloden, the elephant, the ox, and of a number of turtles and mollusks. Of living wild animals there are the black and brown bear, panther, wild cat, fox, raccoon, opossum, woodchuck, deer, rabbit, squirrel, and, near the sea, alligators and turtles. The venomous reptiles are the moccasin, rattle, and copper-head snakes; and the low lands are infested with annoying insects, such as sand flies, mosquitoes, and chigoes or jiggers. Among the birds are, the eagle, several species of the hawk, the turkey-buzzard, the sea-gull, and many smaller kinds, of fine plumage and song. Fish of good quality abound in the rivers, and turtle in the ocean and the sounds. The earliest supplies of shad for the northern markets come from the Savannah and Ogeechee rivers In the higher lands the climate is cool and salubrious; but along the sea-coast it is intensely hot, and malarial diseases are prevalent.

On the alluvial section, near the sea-coast, every variety of tree flourishes, as the live oak, cypress, cedar, palmetto, magnolia, sweet bay, wild orange, cane, and other semi-

tropical trees and plants. Further inland, scrub oaks and yellow pine are found. Still further n.w. are large forests, in which the hickory, tulip, chestnut, black walnut, sycamore, maple, poplar, beech, fir, ash, elm, bay, laurel, and spruce flourish. Tropical fruits, such as the orange, banana, lemon, and olive, are grown in the s.e. section; and in the same region are produced abundant crops of sugar-cane, rice, cotton (long and short staple), and sweet potatoes. Here also grow rich grasses for hay and pasturage. The central portion is favorable for the growth of peaches, apples, pears, cherries, melons, and grapes. Cotton is the main crop in this section, though corn, wheat, oats, rye, barley, and clover are cultivated, and tobacco also, to some extent. Peanuts, sweet potatoes, and sorghum yield abundantly. In the mountainous region the soil is generally thin, but it is a good grazing country. The valleys are fertile and favorable for corn, wheat, clover, and northern fruits. The s.e. section of the state is in the great "cotton belt," and sugar-cane, rice, and sweet potatoes are largely raised there. More than one-half of the land surface of the state is still covered with forests. In 1879 there were in the state 2,413 m. of railway track, belonging to 28 different lines. The Alabama Great Southern, from Wauhatchie, Tenn., to Meridian, Miss., 290 m., has 26 m. in Georgia; the Atlanta and Charlotte Air Line, from Atlanta to Charlotte, N. C., 296 m., has 109 m. in Georgia; the Atlanta and West Point, from East Point to West Point, 81 m., is all in the state; the Atlantic and Gulf, from Savannah to Bainbridge, 237 m., comprises, in addition to the Florida Branch, from Dupont, Ga., to Live Oak, Fla., 49 m., and the Albany Branch, from Thomasville to East Albany, 58½ m.; the Augusta and Savannah, from Miller to Augusta, 53 m.; the Brunswick and Albany, from Brunswick to Albany, 172 m.; the Georgia Central, from Savannah to Atlanta, 294 m., with a branch of 17 m. connecting Gordon with Milledgeville; the Cherokee, from Cartersville to Rockmart, 23 m.; The Eastern Tennessee, Virginia and Georgia, from Bristol to Chattanooga, Tenn., has a branch from Cleveland, Tenn., to Dalton, 30 m.; the Eatonton Branch of the Georgia Central, from Milledgeville to Eatonton, 22 m; the Elberton Air Line, from Tocoa City to Elberton, 50 m.; the Georgia, from Augusta to Atlanta, 171 m., with branches from Union Point to Athens, extending 39 m., and from Barnet to Washington, 17 m., in all 231 m.; the Georgia Southern, from Dalton to the state line, 66 m.; the Macon and Augusta, from Warrenton to Macon, 78 m.; the Macon and Brunswick, from Macon to Brunswick, 187 m., with a branch of 10 m. connecting Cochrane with Hawkinsville; the Marietta and North Georgia, from Marietta to Murphy, N. C., 110 m., is completed to Canton a distance of 23 m.; the North Eastern, from Athens to Lula, 40 m.; the North and South Georgia, from Columbus to Rome, 125 m., is open from Columbus to Hamilton, 23 m.; the Rome, from Rome to Kingston, 20 m.; the Savannah and Charleston, from Savannah to Charleston, 106 m., has 15¼ m. in Georgia; the Savannah, Griffin and North Alabama, from Griffin to Carrolton, 63 m.; the South Western, from Macon to Eufala, 144 m., with branches from Columbus to Fort Valley, 72 m., from Fort Valley to Perry, 13¼ m., from Smithville to Albany, 23¼ m., from Cuthbert to Arlington, 37 m.; the Upson County, from Barnesville to Thomaston, 16½ m.; the Western and Atlantic, from Atlanta to Chattanooga, Tenn., 138 m., of which 121 are in the state, and four or five roads less than 10 m. in length.

The principal towns in Georgia are Savannah, pop. '70, 28,235; Atlanta (the capital), and Macon. There were no others in 1870 having 10,000 inhabitants. The number of organized counties in 1878 was 137. There are but few canals in the state. The tonnage in 1878 was, 76 sailing vessels, 10,184; 24 steamers, 10,124; total, 20,308 tons. The cash value per acre of all crops taken together in 1878, $8.18. Public debt Jan. 1, 1878, $10.644,000; raised by tax in 1877, $1,129,990; rate of tax, 50 cts. on $100; assessed real estate $140,153,250, personal $95,506,280. Area of the state, in acres, 37,120,000.

The school age in Georgia is from 6 to 18; the school population in 1878, 433.444 white, and 197,125 colored; enrolled, 190,626; average attendance, 97,966; income, $400,-000; expenses, $434,046. The higher institutions are Atlanta university (non-sect.), at Atlanta, to which pupils of both sexes are admitted; Clark university (M. Ep.) at Atlanta, both sexes; Emery college (Meth.) at Oxford; Gainsville male and female college (non-sect.); Mercer university (Bap.), at Macon; Pio Nono college (R. C.) at Macon; university of Georgia (non-sect.) at Athens. In all these institutions there were in 1878, 57 instructors, and 779 students. There are also the Baptist institute at Augusta, with three teachers and 113 students; the state college of agriculture at Athens; an agricultural college at Dahlonega, (occupying the old U.S. branch mint buildings); an agricultural department in the university of Georgia; two medical colleges at Atlanta, one at Macon, and one at Augusta, and law departments in the state and the Mercer universities. The Atlanta institute provides a theological course for colored students, and provision is made for them in the university at that place. The masonic grand lodge of the state sustains a female college at Covington, with eight instructors and 114 pupils. There were in the state at the beginning of 1878, 155 newspapers and other serial publications; 11 daily, 2 tri-weekly, 3 semi-weekly, 126 weekly, 2 semi-monthly, and 11 monthly. The statute of limitations fixes four years for open accounts, six for notes, and seven for judgments.

In 1732 George II. granted a patent to certain trustees for settling the "colony of Georgia," and the next year gen. James Oglethorpe explored the country, purchased land from the Creek Indians, and laid the foundation of Savannah. Among those inter-

ested in the colony were the Wesleys and George Whitefield, the founders of Methodism. When war broke out between England and Spain, gen. Oglethorpe was put in command of the troops of South Carolina and Georgia, and led an unsuccessful expedition against St. Augustine. In 1742 the Spaniards retaliated by sending a fleet up the Altamaha river and made some captures, but were repulsed by Oglethorpe. The growth of the colony was slow, and so much complaint was made of the restrictions as to holding slaves that these were removed, and in 1752, after the surrender of their charter by the trustees, the colony came under the government of England, a governor was appointed, and in 1755 a local legislature was established. At that time the boundaries were the Savannah river on the n., the Altamaha on the s., the Atlantic ocean on the e., and the Pacific ocean on the w. If these boundaries had been continued the state would now embrace nearly the whole of the states of Alabama, Mississippi, half of Arkansas, half of Louisiana, half of Texas, a third of the Indian territory, nearly all of New Mexico and Arizona, and nearly half of California. The s. boundary was extended in 1763 to the St. Marys', the present line of Florida; an annexation which included a large and rich rice and cotton region, and was followed by a rapid growth of the colony. Although more remote from the influences of the home government, and having fewer grievances than any other of the colonies, Georgia was prompt to join the colonies in the projected resistance to British rule. A delegate represented Georgia in the continental congress in 1775, and in a convention held the same year the colony accorded full sanction to revolutionary measures. In 1778, British troops overran the colony, and Savannah, Augusta, and Sunbury, were seized in the following year. In 1779 the revolutionists made an unsuccessful attempt to recapture Savannah. A state constitution was formed in 1777, another in 1789, and yet another in 1798, which, with some amendments, remained in effect until Georgia joined the southern confederacy. Troubles with the Cherokee and Creek Indians were continuous from the peace with Great Britain until the cession by the Creeks in 1802; of the territory that now forms the s.w. part of the state; and at a later period a difficulty arose between the federal and state governments concerning the Cherokees, which was not settled until that tribe was removed (in 1838) to the new Indian territory w. of Arkansas, the state coming into possession of their original lands.

Georgia was early in the secession, having, on the 18th of Nov., 1860, ordered a convention to be held at the beginning of the Jan. following. On the 19th of that month an ordinance of secession was adopted by a vote of 208 to 89, and signed by all except six of the delegates. Ten members were sent to the confederate congress, and the confederate constitution was adopted by the state, March 16. Laws were enacted to resume jurisdiction over territory ceded to the United States, and the federal arsonals, forts, and war material were turned over to the confederate government. Fort Pulaski was recaptured in April, 1863, and several seaport towns were occupied. The confederate iron-clad steamer Nashville was destroyed in Ogeechee river early in 1863, and in the same year the iron-clad Atlanta was attacked and disabled. Early in 1864 the state felt the power of the Union arms under gen. Sherman, the confederates being forced to fly from Atlanta Sept. 1. Ten weeks later Sherman began his march to the sea, proceeding directly through the heart of the state. Scouring a district 50 m. wide and ending with the capture of Savannah Dec. 21, the confederates making no attempt at defense, but destroying the navy yard, several vessels, and all military stores. It was near Irwinville in Georgia that the Union cavalry under gen. Wilson captured Jefferson Davis; and it was at Andersonville in Georgia that the confederates had their most notorious military prison. After the final success of the federal arms, Georgia remained under military rule until June, 1865, when a provisional government was established, and in October, delegates were chosen to a state convention, which repealed the secession ordinance and laws, declared the confederate war debt void, amended the state constitution in accordance with the changes in that of the United States, and directed the election of state officers and a legislature. The legislature met Dec. 4, ratified the amendments to the United States constitution, and directed the provisional governor to give place to the one chosen by the state; but this was disapproved by congress, and under the reconstruction acts of 1867 a registration of voters was made (96,262 white and 95,973 colored), and an election held for a new constitutional convention, which consisted of 166 delegates. The whites generally did not vote, and one-fifth of the members of the convention were colored men. A constitution was made in March, 1868, and ratified by vote of the people in April; and on the last day of that month the military government terminated. Subsequently trouble arose in regard to the test oath, and it was not until the 15th of July, 1870, that reconstruction was completed by the president's signing the act for Georgia's re-admission to the Union.

The present constitution gives the suffrage to males 21 years old and over, who are citizens of six months' residence in the state and 30 days in the county, and who have paid such taxes as have been assessed. Defaulters in public funds, and persons convicted of felony or larceny are (unless pardoned), ineligible to office; citizens who engage in duels or abet them can neither vote nor hold office. The senate of 44 members is chosen for four years, half of them retiring every two years. They must be 25 years of age, and two years resident in the state. Representatives (168) are chosen for two years; must be 21 years old, and one year residents of the state. The sessions of the legislature are annual, and limited to 40 days unless extended by a two-thirds vote. Members

are paid $4 per day and mileage. Sectarian appropriations of public money are prohibited; cities and towns cannot be stock-holders in public works unless by vote of their electors. The governor must be 30 years old, have been 15 years a citizen of the Union and six years of the state; continues in office for four years; salary $4,000. In elections, if no one has a majority of the votes for governor, the legislature must choose between the two having the highest votes. There is no lieutenant governor, the president of the senate filling the office of governor when it becomes vacant. Other state officers are appointed by the governor with the advice and consent of the senate. There is a supreme court with three judges, who hold office 12 years; and the usual inferior courts are provided for. Heads of families have homestead exemption to the value of $2,000, and exemption of personal property to the value of $1000, except for taxes, or purchase or improvement of the homestead sought to be exempt. Legal interest is seven per cent., but any amount may be taken upon special agreement, and there is no penalty for usury. Property owned by a woman at the time of marriage, and that inherited, presented, or acquired by her, is her own, and not liable for the husband's debts. Married women have the same rights as single ones in respect to business transactions, and may trade with consent of the husband. The concurrent verdicts of two juries are necessary to effect a complete divorce. Whipping for minor offenses is retained. Treason, arson, murder, rape, and castration are punishable with death. Assignment by a debtor does not discharge his liabilities.

The electoral votes of Georgia for president and vice-president of the United States have been cast as follows:—1789, 5 for Washington for pres., 2 for John Milton of Ga., 1 for James Armstrong of Ga., 1 for Benj. Lincoln of Mass., and 1 for Edward Telfair of Ga. for v. p.; 1792, 4 for Washington and Adams; 1796, 4 for Jefferson and Geo. Clinton; 1800, 4 for Jefferson and Burr; 1804, 6 for Jefferson and Geo. Clinton; 1808, 6 for Madison and Geo. Clinton; 1812, 8 for Madison and Elbridge Gerry; 1816, 8 for Monroe and Dan'l D. Tompkins; 1820, 8 for Monroe and Tompkins; 1824, 9 for Crawford and Van Buren; 1828, 9 for Jackson for pres., and 7 for Wm. Smith of S. C., and 2 for Calhoun for v. p.; 1832, 11 for Jackson and Van Buren; 1836, 11 for Hugh L. White of Tenn. and John Tyler of Va; 1840, 11 for Harrison and Tyler; 1844, 10 for Polk and Dallas; 1848, 10 for Taylor and Fillmore; 1852, 10 for Pierce and King; 1856, 10 for Buchanan and Breckenridge; 1860, 10 for Breckenridge and Lane; 1864, did not vote; 1868, 9 for Seymour and Blair; 1872, 6 for B. Gratz Brown, 2 for C. J. Jenkins of Ga. and 3 not counted for pres., 5 for B. Gratz Brown, 5 for A. H. Colquitt, and 1 for N. P. Banks for v. p.; 1876, 11 for Tilden and Hendricks; 1880, 11 for Hancock and English.

GEORGIA, the name formerly applied in a general manner to the region now called Russian Transcaucasia (see TRANSCAUCASIA), which forms the isthmus connecting Europe with Turkey-in-Asia, and is bounded by the Caucasian mountains on the n., and by the Armenian mountains on the south. The Persian name is Gurjestan; the Russan, Grusia; and the native Iberia; the name of Georgia arose either from the numerous kings called George that ruled over the country, or from the patron saint being St. George.

The early history of the Georgians, who trace their origin to Thargamos, a great-grandson of Japhet, is wrapped in fable. Mtskhethos, who is said to have built Mtsketha, the ancient capital of the country, the ruins of which are still visible near Tiflis, plays a prominent part in it. They appear, however, in authentic history in the time of Alexander the Great, to whom they submitted. After the death of Alexander, in the year 324 B.C., they were delivered from a foreign yoke by Pharnawas, and united in one kingdom. With Pharnawas begins the series of the Mephé or kings of Georgia, who, under a variety of dynasties, ruled the country almost without interruption for more than 2,000 years. By the end of the 4th c., Christianity had diffused itself throughout the country, and through it Georgia became connected with the Eastern empire, with which it joined in repelling the attacks of the Sassanides. After the empire of the Sassanides had been destroyed by the Arabs, the latter carried their conquests into Georgia, which now became a province of the Arabian Califate. Toward the end of the 9th c., during the decline of the Arabian Califate, the Georgians recovered their independence for a short period, but it was only to become tributary in the 10th c. to those dynasties which, in Persia, took the place of the Califs. Toward the end of the 10th c., they again achieved independence, and inaugurated the most brilliant era in Georgian history; for from this period to the 13th c., when they were conquered by the Mongols, Georgia was governed by a series of able sovereigns, who increased its extent, repulsed its enemies, and raised it to great prosperity. Toward the end of the 14th c., the country fell into the hands of Timour, who, however, was driven from it in the beginning of the following century by George VII. Alexander I., the successor of George VII., committed the fatal error of dividing the kingdom between his three sons. Each of these states was again divided, and at one time 26 different princes reigned in Georgia. The general history of Georgia now divides into two parts: that of the eastern states, Karthli and Kacheth; and that of the western states, including Imereth, Mingrelia, and Guria. From the 16th to the 18th c., the eastern states had been heavily oppressed by Persia, and in 1799 Gregory XI., after many attempts to establish their independence,

resigned the states in favor of Paul, emperor of Russia, and in 1802, the emperor Alexander proclaimed the territory a Russian province. Of the three states forming Western Georgia, Guria fell into the hands of Russia in 1801, and formally surrendered itself to that empire by the treaty of 1810; Mingrelia was virtually added to Russia in 1803; and the state of Imereth toward the close of the 18th century. Thus Russia absorbed the whole of Georgia, which is now included within the two governments, Tiflis and Kutais, of the lieutenancy of the Caucasus. These governments are very fertile, abundantly productive of cereals, wine, honey, and silk, of cattle and horses, while the mountains teem with mineral wealth, as yet little utilized.

The Georgians are one of that numerous group of nations or tribes that inhabit the Caucasus, to which Dr. Latham has given the name of Dioscurians (see CAUCASUS). They are celebrated for their beauty, and, under the Mohammedan rule, the white slaves of western Asia and of Egypt were mostly drawn from among them and the Circassians. Though endowed by nature with mental, no less than physical advantages, the long course of oppression to which they have been subjected has had its effect both upon their intelligence and their morality. Despite the long supremacy and cruel tyranny of their Mohammedan conquerors, they have, as a nation, remained faithful to the Christian religion, according to the doctrines of the Greek church. In Guria, however, nearly half the inhabitants have gone over to the religion of Islam. The condition of the people, although somewhat ameliorated under Russian rule, is, on the whole, deplorable.

The language of the Georgians is harsh, but regular and forcible. It has a peculiar structure, but is clearly of the agglutinative type. Along with the languages of one or two allied tribes, it constitutes a group to which the name *Iberian* has been given. The Georgian literature, which is not altogether unimportant, begins with the introduction of Christianity into the country, and consists chiefly of ecclesiastical writings, translations of the Bible, the fathers, Plato, Aristotle, and their commentators. Profane literature flourished chiefly in the 17th c., and consists mainly of poetry and chronicles, particularly of an ecclesiastical character. A few heroic poems may be traced back to the time of queen Thamar (1184–1206). Scientific works are few in number, and with the exception of a few historical works, are of no importance. Recently, however, a greater zeal in the cultivation of the sciences has begun to show itself among the Georgians, and under the Russian government, the system of education and instruction has progressed considerably. On the other hand, it must be regarded as a circumstance unfavourable to the mental culture of the country, that, in 1807, the archives and scientific works of Georgia were conveyed to St. Petersburg. The chief authority on the language, literature, and history of Georgia is Brosset. Besides the translation of a Georgian chronicle, he published, among other works, the *Elements de la Langue Georgienne* (Paris, 1837); the *Rapport sur un Voyage Archéologique dans la Georgie et dans l'Arménie exécuté en* 1847–48 (Petersburg, 1850–51); *L'Histoire de la Georgie*, in Georgian and French; and *Additions et Eclaircissements à l'Histoire de la Georgie* (Petersburg, 1851).

GEORGIA, GULF OF, an arm the north Pacific ocean, between Vancouver's island and the mainland of British Columbia. It averages 20 m. in width, is 100 m. in length, receives Fraser river (q.v.), and communicates with the open ocean by queen Charlotte's sound in the n., and by the strait of Fuca in the south. Its southerly entrance is about lat. 49° n. and long. 124° west.

GEORGIA BARK. See PINCKNEYA.

GEORGIAN BAY, an e. extension of lake Huron in the province of Ontario, Canada, about 120 m. long and 50 m. wide. It is separated from the lake by Great Manitoulin island and the peninsula which terminates at Cabot Head.

GEORGIA, UNIVERSITY OF, at Athens, Clarke co., was founded in 1800. It is undenominational. It has an endowment of $370,000, and an annual income of over $33,000. Its buildings, which comprise a library, museum, chancellor's office and halls, chapel, a large edifice for chemical, philosophical, and engineering departments, professors' residences, and farm buildings, are valued at $120,000. The campus embraces 16 and the farm 80 acres. There is philosophical and chemical apparatus, models in engineering, and complete sets of surveying instruments, a cabinet of mineralogy and geology, and a library containing 13,000 volumes. The university embraces five departments—1, academic department (known as the Franklin college); 2, state college department; 3, law department; 4, North Georgia agricultural college (at Dahlonega); 5, medical college (at Augusta). Tuition without payment is given to fifty meritorious students. Candidates for the ministry, of any denomination, are admitted without the payment of tuition fees, upon presenting proper letters from the authorities of the church to which they may be attached. The state college department embraces schools of agriculture, engineering, and applied chemistry. In the academic department (Franklin college) there are (1879) 9 professors; in the state college, 8; in the law school, 5. The total number of students in these departments is 149. Students in the agricultural department, 323; in the medical department, 77. Total, 549.

GEORGSWALDE, a small t. on the northern border of Bohemia, 64 m. n. of Prague. It has a mineral spring and some manufactures of linen. Pop. '69, 8,220.

GEOTEU'THIS, a genus of fossil calamaries peculiar to the oolitic period. The shell or horny pen is broad and truncated in front, and pointed behind, with the lateral wings shorter than the shaft. Some specimens from the Oxford clay are remarkably preserved, still showing the muscular mouth, the bases of the arms, and the ink-bag. The ink has been made into sepia. Some of the ink-bags from the lias are nearly a foot long, and are invested with a brilliant nacreous layer. Upwards of a dozen species have been found.

GEPIDÆ, a people of Germanic origin, in the 3d c. living on the shores of the Baltic near the river Vistula. They were subjected by Attila, but becoming independent after his death, rose and drove out the Huns. They were completely defeated by Theodoric the Ostrogoth king in 488, and when, in 566, they were subjugated by the Avars, who came to the assistance of the Lombard king, they lost all independence and became merged with other races.

GERA, a t. of Germany, the chief place in the small principality of Reuss-Schleiz, is pleasantly situated on the right bank of the White Elster, 35 m. s.s.w. of Leipsic. It is handsomely built, with broad and regular streets, and has six squares, a castle, a fine town hall, and several religious and educational institutions. There are extensive manufactures of woolen and cotton goods, also machine making, and manufactures of soap, gloves, leather, hats, tobacco, waxcloth, ironware, stoneware, and porcelain. The recent prosperity of the town is seen in the increase of the population from 11,300 in 1843 to 20,810 in 1875. Ten manufactories of harmonicas employ 1500 hands. Beer is extensively manufactured for export.

GERA'CE, an ancient commercial t. in the s. of Italy, chief town of the district of the same name, in the province of Reggio, occupies a beautiful and fertile situation on the upper slopes of the Apennines, at about four miles' distance from the Ionian sea. On the destruction of the ancient town of Locri by the Saracens in the 12th c., the inhabitants, out of the ruins of their homes, constructed a new settlement about 4 m. from the site of Locri, on the sea-shore, and called it Santa Ciriace, which has since become *Gerace.* This town has suffered severely from repeated earthquakes, in one of which, in 1783, both the cathedral and the citadel, a fortress of great strength, were reduced to ruins. In a neighboring plain are seen ruins supposed to occupy the site of Locri Epizephyrii, an important city of Magna Grecia, celebrated by Pindar in more than one of his odes. Coins bearing the epigraph of Locri have been found in the vicinity of the ruins, and together with the Greek character borne by the ruined edifices, seem to support this supposition. The modern Gerace is well built, and owes its commercial prosperity to its silk factories and its trade in wine, a sweet white kind of which, known as "il Greco di Gerace," is deservedly held in high repute. Pop. about 5,000.

GERANDO, DE. See DEGERANDO, *ante.*

GERANIA'CEÆ, a natural order of exogenous plants, consisting of herbaceous plants and shrubs, of which about 500 species are known, distributed over the whole world, and particularly abundant in s. Africa. The stems are jointed, usually tumid, and easily broken at the joints. The leaves are simple in some, divided in others, opposite, or alternate, with flower-stalks opposite to them; they have membranous stipules. The calyx consists of five persistent sepals; the corolla of five petals, which are clawed. The stamens are united by their filaments, hypogynous, twice or thrice as many as the petals. The ovary consists of five carpels, placed around a long awl-shaped *torus* or *carpophore,* to which the styles cohere; ripening into a fruit which consists of five small one-seeded shells, cohering around the base of a long beak, the indurated style of each carpel finally curling back from the base upward, and carrying the seed along with it. The indurated styles are in many species extremely hygroscopic, and their twistings and untwistings seem intended to move the seed after it has fallen, until it reach a fit place for its germination. See GERANIUM.

GÉRARD, ETIENNE-MAURICE, Comte, marshal of France, was b. at Damvilliers, in Lorraine, on the 4th of April, 1773. He enrolled as a volunteer in the second battalion of the Meuse, and served during the campaign of 1792–93 under Dumouriez and Jourdan, and afterwards accompanied Bernadotte on his embassy to Vienna, where he was the means of saving his master's life in the *mêlée* that ensued on his arrival. After rising rapidly through the different grades of promotion, he was appointed colonel on Nov. 15, 1800, and in 1805 aid-de-camp to his friend Bernadotte. He specially distinguished himself at Austerlitz (1805), in consequence of which he was appointed general of brigade, at Halle (1806), Jena (1806), Erfurt (1806), Lintz (1809), and Wagram (1809). On the morning after this last battle, he received the title of baron of the empire. He took part both in the wars of the Spanish peninsula and in the Russian campaign; and in 1812 was made a general of division. Subsequently, Napoleon named him count of the empire. After the first restoration, he was named grand cross of the legion of honor, and chevalier of St. Louis, and received various honorable appointments. On the return of Napoleon from Elba, Gérard joined him, and commanded the fourth corps, numbering 16,000 men. At the battle of Ligny, Gérard was opposite to the center of the Prussian position, which covered Ligny, and was thus in the hottest of the fight

On the morning of June 18th, Gérard was near Wavres, when firing was heard in the direction of Soignies, upon which a council was called, and if Gérard's advice had been taken, the battle of Waterloo might perhaps have had a different result. After the second restoration, Gérard was obliged to leave France, and did not return till 1817. He was elected a member of the chamber of deputies in 1822; he also took an active part in the revolution of 1830, and commanded the troops appointed to maintain order and tranquility in Paris. In 1831, Louis Philippe appointed Gérard a marshal of France, and gave him the command of the expedition to Belgium, in the course of which he distinguished himself by taking Antwerp in Dec., 1832. In 1835, he succeeded marshal Mortier as grand chancellor of the legion of honor. He died April 17, 1855.

GÉRARD, FRANÇOIS PASCAL, Baron, one of the first historical and portrait painters of the modern French school, was b. at Rome, March 11, 1770. At an early age he went to France and was apprenticed to Pajou, the sculptor, in Paris. He afterwards worked for some time in the studio of the painter Brenet, and in his 16th year became the pupil of David, but his artistic career was interrupted for several years by the revolution. In 1795, he exhibited his first picture, "Belisarius;" some time after, he painted "Psyche Receiving the First Kiss from Cupid." Encouraged by his success, he now turned his attention to portrait-painting. Having gained Napoleon's favor, he was loaded with honors, and received, among other commissions, that of painting the battle of Austerlitz, perhaps the most successful of his paintings illustrating the campaigns of Napoleon. But his grandest work—both as regards size and merit—is his "Entrance of Henri Quatre into Paris." It is 30 ft. wide by 15 high, glowing with life, bright with color, and accurate in costume. It was painted in 1817. Gérard was shortly after appointed first court-painter, and raised to the rank of baron by Louis XVIII. He died at Paris, Jan. 11, 1837. Gérard's most celebrated portraits are those of Napoleon in his coronation robes, the queen of Naples and her children; Talleyrand, Talma, Louis Philippe, and Madame Recamier. Of his other pictures, the best known are "Ossian's Dream" (engraved by Godefroy), "Homer" (engraved by Massard), "Daphnis and Chloë," "Philip V.," "Corinna on the Promontory of Misena," "St. Theresa Kneeling at the Altar," and "Thetis Bearing the Armor of Achilles."

GERA'NIUM, a genus of exogenous plants, the type of the natural order *geraniaceæ*, the limits of which correspond with those of the linnæan genus. This order contains at least 500 known species, very unequally distributed over the world, and particularly abounding at the cape of Good Hope, of which country most of the species of the large genus *pelargonium* are natives—a genus distinguished by an irregular corolla and by a nectariferous tube running down the flower-stalk. Many species of *pelargonium*, and many fine hybrids and varieties produced by cultivation are to be seen in green-houses, and some of them are frequent in cottage-windows. The name geranium is still very frequently given to them. The British *geraniaceæ* are thirteen species of *geranium* and three of *erodium*, all herbaceous. Some of them are common weeds in fields and gardens, with small flowers; others have large and beautiful flowers, and are among the finest ornaments of groves and meadows. Some species of *geranium* are often cultivated in flower-gardens. The name *geranium* (Gr. *geranos*, a crane), the popular English name *crane's-bill*, and the German *storchsnabel*, all refer to the beaked fruit. The *geraniaceæ* are generally characterized by astringency; many have a disagreeable, others a pleasantly aromatic and resinous smell, some a delightful fragrance. The STINKING CRANE'S-BILL or HERB ROBERT (*geranium Robertianum*), a common weed in Britain, with a diffuse habit, deeply divided leaves, and small flowers, has been used medicinally as an astringent, and in nephritic complaints. *G. maculatum*, a North American species, with flowers of considerable beauty, is the most valuable medicinal plant of the order. Its root, called ALUM ROOT in America, is extremely astringent, and abounds in tannin: it is used for gargles and as a medicine in various diseases.

A few *geraniaceæ* produce edible tubers: those of *geranium tuberosum* are eaten in the s. of Europe; those of *G. parviflorum* in Van Diemen's Land, where they are known as *native carrot;* and those of *pelargonium triste* at the cape of Good Hope. The leaves of *pelargonium acetosum* and *P. peltatum* are edible, and gratefully acid. The cultivated *geraniaceæ* are propagated by seed or by cuttings; the shrubby kinds are very easily propagated by cuttings. They require a light rich soil: a mixture of leaf mold and sand is very suitable. They are kept low by pruning, to increase their beauty and make them more productive of flowers.

GERARD THE BLESSED (Tum, Tunc, Tenque, or Thom), 1040–1120; founder of the order of the knights hospitallers of St. John or of Malta. Whether as a soldier or a merchant, he in the course of the latter part of the 11th c. found his way to Jerusalem, where a hospice had for some time existed for the convenience of those who wished to visit the holy places. Of this institution Gerard became guardian or provost at a date not later than 1100: and here he organized that religious order of St. John which received papal recognition from Pascal II. in 1113, by a bull which was renewed and confirmed by Calixtus II. shortly before the death of Gerard.

GERARD, CÉCILE JULES BASILE, 1817–64; a French traveler better known as "Gerard the Lion-hunter." His adventures in Algeria were chronicled in *La Chasseau*

Lion, and *Gerard le tueur des Lions*. In 1863, he started on a tour of exploration in w. Africa, and met his death by drowning, the following year.

GERARD, JEAN IGNACE ISIDORE, 1803–47, a French caricaturist generally known by the pseudonym of Grandville—the professional name of his grandparents, who were actors. He received his first instruction in drawing from his father, a miniature painter, and at the age of twenty-one went to Paris, where he soon afterwards published a collection of lithographs entitled *Les Tribulations de la petite propriété*. He followed this by *Les plaisirs de tout âge*, and *La sibylle des salons;* but the work which first established his fame was *Métamorphoses du jour*, published in 1828, a series of 70 scenes in which individuals with the bodies of men and faces of animals are made to play a human comedy. These drawings are remarkable for the extraordinary skill with which human characteristics are represented in animal features. The success of this work led to his being engaged as artistic contributor to various periodicals such as *La Silhouette*, *L'Artiste*, *La Caricature*, *Le Charivari;* and his political caricatures, which were characterized by marvelous versatility of satirical humor, soon came to enjoy a general popularity which never diminished. Besides supplying illustrations for various standard works, such as the songs of Beranger, the fables of La Fontaine, *Don Quixote*, *Gulliver's Travels*, *Robinson Crusoe*, he also continued the issue of various lithographic collections, among which may be mentioned *La vie privée et publique des animaux*, *Les cent proverbes*, *L'autre monde*, and *Les fleurs animées*. Though the designs of Gerard are occasionally unnatural and absurd, they usually display keen analysis of character and marvelous inventive ingenuity, and his humor is always tempered and refined by delicacy of sentiment and a vein of sober thoughtfulness.

GERARD, JOHN, 1545–1608, herbalist and surgeon. He was educated at Wisterson, and after spending some time in traveling, took up his abode in London, where he exercised his profession. For more than twenty years he also acted as superintendent of the gardens of lord Burghley, secretary of state to queen Elizabeth. In 1596, he published a catalogue of plants cultivated in his own garden, 1039 in number, inclusive of varieties of the same species. Their English as well as their Latin names are given in a revised edition of the catalogue issued in 1599. In 1597, appeared Gerard's well-known *Herball*, described by him in its preface as "the first fruits of these mine own labors," but more truly an adaptation of the *Stirpium historiæ pemptades* of Rembert Dodoens, published in 1583, or rather of a translation of the whole or part of the same by Dr. Priest, with L'Obel's arrangement. Of the numerous illustrations of the *Herball* sixteen appear to be original, the remainder are mostly impressions from the wood-blocks employed by Jacob Theodorus (Tabernæmontanus) in his *Icones Stirpium*, published at Frankfort in 1590. A second edition of the *Herball*, with considerable improvements and additions, was brought out by Thomas Johnson in 1633, and reprinted in 1636. Gerard was elected a member of the court of assistants of the barber-surgeons in 1595, by which company he was appointed an examiner in 1598, junior warden in 1605, and master in 1608.

GERARDMER, GEROME, or GEROMIEX, a t. in Vosges department, France, near the German frontier; pop. 2,331. It has a large trade in the well-known Gerome cheese. Near by is a beautiful lake through which runs the Valonge river.

GERA'SA, in the time of the Romans was a city of Palestine, on the eastern borders of Peræa. It was situated among the mountains of Gilead, about 20 m. e. of the Jordan, and 25 n. of Rabbath-Ammon, and attained a high degree of prosperity under the Antonines (138–180 A. D.). On the rise of Christianity, it became the seat of a bishopric, but subsequently sunk into decay. Gerasa is now deserving of notice solely on account of its ruins, which are said to be the most beautiful and extensive in that part of Palestine lying e. of the Jourdan. In fact, it presents the appearance of a city in ruins, but which still preserves its original outlines. Great portions of the wall surrounding the town are in good preservation; three of the gateways are almost perfect, and within the city more than 230 columns are still standing on their pedestals.

GERBERT, MARTIN, 1720–93, a Roman Catholic prelate and writer on church music, and a descendant of the Gerberts of Hornau. He received his education at the Jewish school of Freiburg in the Breisgau, at Klingenau in Switzerland, and at the monastery of St. Blaise in the Black Forest. He joined the order of the Benedictines in the monastery of St. Blaise in 1736, became priest in 1744, was soon thereafter appointed professor of theology, and was chosen abbott in 1764. From 1759 to 1762 he traveled in Germany, Italy, and France, chiefly with a view of obtaining access to the old collections of musical literature contained in the libraries of the monasteries. In 1774, he published two volumes, *De cantu et musica sacra;* in 1777, *Monumenta veteris liturgiæ Alemannicæ;* and in 1784, in three volumes, *Scriptores ecclesiastici de musica sacra*, a collection of the principal writers on church music from the 3d c. till the invention of printing. Although this work contains many textual errors, its publication has nevertheless been of very great importance for the history of music, by preserving writings which otherwise might either have perished or remained unknown. He is also the author of *Codex epistolaris Rudolphi I.*, 1772, and *Historia Nigræ Silvæ*, Cologne, 1783–88. His interest in music led to his acquaintance with the composer Gluck, who became his intimate friend

GERBI, Gerba, or Jerba (the Meninx of Strabo and Pliny), a small island on the n coast of Africa belonging to the state of Tunis, is situated on the gulf of Cabes, and is separated by a strait from a headland on the shore. It is about 20 m. long and 12 m. broad, and is fertile and populous. Shawls of brilliant colors, beautiful silk and woolen fabrics of the finest texture, bornous and blankets, are manufactured. This island contains a triumphal arch in honor of Antoninus and Verus, and a pyramid from 25 to 30 ft. in height, built up of the skulls of the Spanish soldiers who fell here in a disastrous battle with the Turks in the 6th century.

GERBIL, a genus of rodents much like rats, in Africa, Asia, and Europe. They live under ground and store grain for food in their burrows. They are of fawn color, very lively, and emit an offensive odor.

GERBOA. See Jerboa, *ante.*

GERFALCON, or Jerfalcon. See Gyr-falcon, *ante.*

GERHARD, Frederick William Edouard, 1795–1867; a German archaeologist After studying at Breslau and Berlin, he, in 1816, took up his residence at the former town. The reputation he acquired by his *Lectiones Appollonianae*, published in the same year, led soon afterwards to his being appointed professor at the gymnasium of Posen. On resigning that office in 1819, on account of weakness in the eyes, he traveled in Italy, and in 1822, he took up his residence in Rome, where, with a view of prosecuting his archaelogical studies, he remained for fifteen years. He there contributed to Platner's *Beschreibung der Stadt Rom*, then under the direction of the *Instituto di corrispondenza archeologica*, founded at Rome in 1828, and during his stay in Italy, was its director. After his return to Germany in 1837, he was appointed archaelogist at the royal museum of Berlin, and in 1844, was chosen a member of the academy of sciences, and a professor in the university.

GERHARD, Johann, 1582–1637; one of the ablest and most learned exponents of Lutheran orthodoxy. In his fifteenth year he came under the personal influence of Johann Arndt, author of *Das Wahre Christenthum*, and resolved to study for the church. Soon after entering the university of Wittenberg, however, in 1599, he began to waver in this determination, and ultimately gave himself for two years to the study of medicine, but in 1603 resumed his theological reading at Jena, and in the following year received a new impulse from Winkelmann and Mentzer, at Marburg. Having graduated and commenced giving lectures at Jena in 1605, he, in 1606, received and accepted the duke of Coburg's invitation to the superintendency of Heldburg and mastership of the gymnasium; soon afterwards he became general superintendent of the duchy, in which capacity he was much and usefully engaged in the practical work of ecclesiastical organization until 1616, when he found a more congenial sphere in the senior theological chair at Jena, where the remainder of his life was spent. Though still comparatively young, Gerhard had already come to be regarded as the greatest living theologian of Protestant Germany; in the numerous "disputations" which characterized that period he was always protagonist, while on all public and domestic questions touching religion or morals, his advice was eagerly sought on all hands and by every class. It is recorded that during the course of his lifetime he received repeated calls to almost every university in Germany, as well as to Upsala, in Sweden.

GERHARDT, Karl Friedrich, an eminent chemist, was b. at Strasburg on Aug. 21, 1816, and d. in that city on Aug. 19, 1856. At the age of 15, he was sent to the Polytechnic school at Carlsruhe, where his attendance at prof. Walchner's lectures first awaked in his mind a taste for chemistry. After two years' residence in this town he removed to Leipsic, where he attended the lectures of Erdmann, which seem to have developed in him an irresistable passion for questions of speculative chemistry.

On his return home, he reluctantly entered upon the business of his father, who was a manufacturer of chemical products; but the requirements of commerce seem to have been intensely repugnant to him, and in a hasty moment of passion he enlisted (being now in his twentieth year) in a regiment of chasseurs. He soon, however, found a military life as insupportable as a commercial career, and in the course of three months he purchased his discharge, and at once set out for the laboratory of Giessen, where he worked under Liebig's superintendence for 18 months. In 1838, he arrived in Paris, where he was cordially welcomed by Dumas. Here he gave lectures and instructions in chemistry, and, with Chevreul's permission, worked in the laboratory of the Jardin des Plantes, where, in association with his friend Cahours (to whose memoir of Gerhardt we are indebted for many of the facts noticed in this article), he commences his important researches on the essential oils. In 1844, he was appointed professor of general chemistry in the faculty of sciences at Montpelier, and in the same year he married the youngest daughter of the late Dr. James Sanders of Edinburgh. About this time he published his *Précis de Chimie Organique*, in which he sketches the idea of "Homologous and Heterologous Series" (q.v.), which at a later period he so successfully developed. In 1845, in association with Laurent, he commenced the *Comptes rendus des Travaux de Chimie publiés en France et à l'Etranger*, which were continued till 1848. In 1848, he resigned his chair and returned to Paris, in order to follow out uninterruptedly his special investigations; and in that city he established, between the

years 1849 and 1855, in successive memoirs, his views of series (already adverted to) and the theory of types, with which his name will be ever associated in the history of chemistry. It was there, also, that he gave to the scientific world his remarkable researches upon the anhydrous acids and the oxides. All his ideas and his discoveries are embodied in his *Traité de Chimie Organique* (1853–56, 4 vols.), which forms, to use the words of his friend and biographer Cahours, "an important monument of modern science." He had hardly completed the correction of the last proof of this great work, when, after an illness of only two days, he was surprised by the hand of death at the very period when he seemed to be beginning to enjoy the fruit of his labors; for he had just received the diploma of corresponding member of the academy of sciences at Paris, and in the previous year he was appointed professor of chemistry at Strasburg.

GERHARDT, Paul, 1606–76, the greatest hymn-writer of Germany, if not of Europe, was b. of a middle-class family at Grafenhainichen. His education appears to have been retarded by the troubles of the period, the thirty years' war having begun about the time he reached his twelfth year. After completing his studies for the church, he is known to have lived some years at Berlin as tutor in the family of an advocate named Berthold, whose daughter he subsequently married, on receiving his first ecclesiastical appointment at Mittelwald in 1651. In 1657, he accepted an invitation as "diaconus" to the Nicolaikirche of Berlin; but in consequence of his uncompromising Lutheranism in refusing to accept the elector Frederick William's "syncretistic" edict of 1664, he was deprived in 1666. Though absolved from submission and restored to office early in the following year, on the petition of the citizens, his conscience did not allow him to retain a post, which, as it appeared to him, could only be held on condition of at least a tacit repudiation of the Formula Concordiæ, and for upwards of a year he lived in Berlin without fixed employment. In 1668, he was appointed archdeacon of Lübben in the duchy of Saxe-Merseburg, where, after a somewhat somber ministry of eight years, he died on June 7, 1676. Many of his best known hymns were originally published in various church hymn-books, as for example in that for Brandenburg which appeared in 1658; others first saw the light in Johann Cruger's *Geistliche Kirchenmelodien* (1649) and *Praxis Pietatis Melica* (1656).

GERHARDT'S NOTATION. On certain theoretical grounds, Gerhardt doubled the numbers that had hitherto been current, expressing the atomic weights of certain of the chemical elements—oxygen, carbon, sulphur, selenia, and tellurium; the other numbers remaining unaltered. We give in the following table the earlier system and Gerhardt's numbers:

	Old Equivalent.	Gerhardt's Equivalent.
O,	8	16
C,	6	12
S,	16	32
Se,	39·75	79·5
Te,	64·5	129

The examination of a few formulæ will readily enable the reader to translate from one system into the other:

Compounds.	Old Formulæ.	Gerhardt's Formulæ.
Water	HO	$H_2\mathit{O}$
Potash	KO	$K_2\mathit{O}$
Hydrate of potash	KO,HO	$KH\mathit{O}$
Hydrated nitric acid	HO,NO_5	$N\mathit{O}_3H$
Hydrated sulphuric acid	HO,SO_3	SO_4H_2
Hydrated acetic acid	$HO,C_4H_3O_3$	$\mathit{C}_2H_4\mathit{O}_2$
Alcohol	HO,C_4H_5O	$\mathit{C}_2H_6\mathit{O}$

In Gerhardt's formulæ the symbols whose equivalents are changed are printed in italics. Each system of notation seemed to have its advantages; and until the original publication of this work was far advanced, most British chemists adhered to the old, which for the sake of uniformity was maintained to the end of the encyclopædia. In the end, however, the new atomic weights gained the day; and in the SUPPLEMENT a further account is given of the change and of the reasons by which it is justified. The general principle on which it is grounded is, "that the atomic weights of an element and of its combinations should be selected so as to express the entire series of combinations by the simplest series of formulæ; so as best to accord with the chemical properties and metamorphoses of the bodies; so as best to illustrate their analogies with other bodies; and so as to be in relation with their physical properties, such as their specific volumes, specific heats, isomorphism, &c."

GERICAULT, Jean Louis André Théodore, 1791–1824, a French painter who led the reaction which set in under the empire against the fixed and frigid classicalities of the school of David. In 1808, he entered the studio of Charles Vernet, from which, in 1810, he passed to that of Guérin, whom he drove to despair by his passion for Rubens, and by the unorthodox manner in which he persisted in interpreting nature. At the salon of 1802, Géricault attracted attention by his "Officier de Chasseurs à Cheval," a work in which he personified the cavalry in its hour of triumph, and turned to account

the solid training received from Guérin in rendering a picturesque point of view, which was in itself a protest against the cherished convictions of the pseudo-classical school. Two years later he re-exhibited this work acccompanied with the reverse picture "Le Cuirassier Blessé," and in both subjects called attention to the interests of modern aspects of life, treated neglected types of living form, and exhibited that mastery of and delight in the horse which was a prominent feature of his character. Disconcerted by the tempest of contradictory opinion which arose over these two pictures, Gericault gave way to his enthusiasm for horses and soldiers, and enrolled himself in the *mousquetaires*. During the hundred days he followed the king to Bethune, but, on his regiment being disbanded, eagerly returned to his profession, left France for Italy in 1616, and at Rome nobly illustrated his favorite animal by his great painting "Course des Chevaux Libres." Returning to Paris, Gericault exhibited at the salon of 1819, the "Radeau de la Méduse," a subject which not only enabled him to prove his zealous and scientific study of the human form, but contained those elements of the heroic and pathetic, as existing in situations of modern life, to which he had appealed in his earliest productions. Easily depressed or elated, Gericault took to heart the hostility which this work excited, and passed nearly two years in London, where the "Radeau" was exhibited with success, and where he executed many series of admirable lithographs. At the close of 1822, he was again in Paris, and produced a great quantity of projects for vast compositions, models in wax, and a horse *écorché*, as preliminary to the production of an equestrian statue. His health was now completely undermined by his excesses and on Jan. 26, he died.

GER'IZIM AND E'BAL, two mountains celebrated in Scripture story. They are separated from each other by a narrow valley-about 200 yards wide, in which stands the town of Nâbulus, the ancient Shechem or Sychar, the metropolis of the Samaritan sect. They are nearly equal in altitude, neither of them exceeding 700 or 800 ft. above the level of the valley, which, however, is itself 1800 ft. above the sea. The view from the top of Mt. Gerizim, the southern hill, is said to be among the finest in Palestine, embracing, as it does, glimpses of the blue waters of the Mediterranean on the w., the snow-capped heights of Hermon on the n., and on the e. the wall of the trans-Jordanic mountains, broken by the deep cleft of the brook Jabbok.

In all probability, mount Gerizim, and not the mere hillock called Moriah, on which Solomon afterwards built the temple, was the place where Abraham offered up his son Isaac. Along with Mt. Ebal, it was also the scene of a grand and impressive ceremony, in which the whole people of Israel took part after crossing the Jordan, in obedience to a command which Moses had given them. Half of the tribes stood upon the declivities of the one hill; the rest occupied the sides of the other, while in the valley between, the Levites, surrounding the sacred ark, pronounced, "with loud voice," the blessings affixed to the performance of the law, and the curses affixed to the of it. According to the mishna, their manner of procedure was as follows: They first turned towards Gerizim, and pronounced the blessing, whereupon the vast host that thronged the ascent of that hill rolled back their multitudinous "Amen;" then turning towards Ebal, they uttered the corresponding malediction, to which the tribes there stationed responded in deep and solemn tones. In this way, alternating blessing and curse, they went through the whole series. The narrative of the ceremony (which is to be found in the 27th chapter of Deuteronomy) gives only the curses—the customary explanation of which fact is, that probably these were merely the reverse form of the blessings, and may have been selected by the writer of the book on account of the greater awe inspired, among a rude people, by a malediction than a benediction. At a later period the Samaritans, by permission of Alexander the great, built a temple on mount Gerizim, as a rival to that of Jerusalem, and organised a rival priesthood. And though this temple was destroyed by Hyrcanus about 200 years after, the mountain on which it stood continued to be held sacred by the Samaritans. It was to Mt. Gerizim that the "woman of Samaria" referred when she said to our Saviour: "Our fathers worshipped in *this* mountain, and ye say that in Jerusalem is the place where men ought to worship." Subsequently, a Christian church in honor of the virgin was built on it, which Justinian surrounded with a strong wall to protect it against the assaults of the Samaritans, who were even then a powerful and important sect. The ruins of this wall are still visible.

GERKI, a considerable t. of Africa, is situated in the Sûdan, in the district of Sokoto, in lat. 12° 26′ n., and long. 9° 10′ east. It is surrounded by a wall surmounted with pinnacles. Its inhabitants are notorious for their thievish propensities, and for their aversion to agriculture, and, indeed, to any form of industry. Pop. estimated at 15,000.

GERLACH, ERNEST LUDWIG VON, b. Berlin, 1795; an ultra conservative politician of Germany, the leader of the Prussian high-church party. He is also a prominent journalist.

GERLACH, OTTO VON, 1801–49; a German theologian who held many ecclesiastical offices, and was professor in Berlin. He was the author of a number of works, among which are commentaries on the Scripture. He also edited Luther's writings.

GERLACHE, ETIENNE CONSTANTIN, Baron de, a native of the province of Luxemburg, in Belgium, was born on Dec. 26, 1785. In 1824, he was elected as deputy from the province of Liege to the second chamber of the "states general." At the time of the revolution, Gerlache presided over the committee appointed to revise the constitution, and was head of the deputation sent to offer the crown to Prince Leopold of Saxe-Coburg. In 1831, he became president of congress, and in that capacity received the oath exacted from the king by the constitution, and the following year was appointed first president of the "court of cassation." In 1843, the king conferred on him the title of baron. After his election as deputy in 1824, he supported the Catholic party, and was considered as one of their chief leaders. He took no part in political matters after 1837, when he retired from his office as president of the court of cassation. He died in 1871. Gerlache also acquired a literary reputation. His most important works are: *Mémoires sur les Changements à apporter aux Tarifs du Royaume* (1821–24); *Histoire du Royaume des Pays-Bas, depuis* 1814 *jusqu'en* 1830 (1839), besides other works of local interest.

GERM. See EMBRYO, *ante.*

GERMAINE, LORD GEORGE, 1716–85; an English statesman known as viscount Sackville. He was the son of the duke of Dorset, and served creditably in the army in Germany. He was a member of parliament in 1761, and colonial secretary of state through the American revolutionary war, and was at all times a determined supporter of English policy.

GERMAN, SAN, a t. in the s.w. of the Spanish island of Porto Rico, stands in lat. 18° 10′ n., long. 67° w. It is situated about 10 m. from the sea, in the center of a district productive in cotton, coffee, and cattle. Its population is estimated at 9,125.

GERMAN BARM. See YEAST.

GERMAN CATHOLICS is the name generally given to a religious sect that has recently sprung up in Germany in the bosom of the Roman Catholic church. Though retaining the designation Catholic—i. e., universal—they form independent congregations, and most commonly style themselves Christian Catholics. So far as their general principles are concerned, the German Catholics stand upon Protestant ground; but neither in theory nor practice are they evangelical Protestants, nor do they wish to be accounted such.

Whatever might be the deeper causes of the schism, the immediate occasion of it was the exhibition of the holy coat at Treves. In 1844, bishop Arnoldi appointed a special pilgrimage and service to this relic, to be preceded by confession and remission of sins. This proceeding called forth a protest from J. Ronge (pronounced Rongé, the *g* hard), a priest in Silesia, who, having quarreled with the authorities of his church, had been suspended from his office, and was living in retirement. Ronge addressed a public letter to bishop Arnoldi, Oct. 1, 1844, in which he characterised the exhibition of the coat as idolatry. Ronge's voice found a vivid response in the minds of many Catholics, and was also approved by Protestants.

A short time previous to the publication of this letter, J. Czerski, a priest at Schneidemühl, in Posen, had seceded from the Roman Catholic church, and was about to form a congregation of "Christian Apostolic Catholics." Czerski and Ronge were naturally drawn into confederacy. Ronge at last addressed an appeal to the lower orders of the priesthood, calling upon them to use their influence in the pulpit and everywhere to break the power of the court of Rome, and priestcraft in general, throughout Germany; to set up a national German church independent of Rome, and governed by councils and synods; to abolish auricular confession, the Latin mass, and the celibacy of the priests; and to aim at liberty of conscience for all Christians, and perfect freedom for the religious education of children.

The first congregation of the new church was formed at Schneidemühl, and took the name of Christian Catholic. The confession of faith, which was drawn up by Czerski, differed little in point of doctrine from that of the Catholic church. The Holy Scriptures and the Nicene creed were held to be the only standards of Christian faith, and were to be understood in the sense patent to every enlightened and pious Christian. Nothing was said against the worship of saints and relics, pilgrimages, confession, etc. This confession of Schneidemühl served many other congregations as a groundwork, though some of them modified it in various ways, and expressed themselves more definitely. The new sect quickly increased. At the beginning of 1845, more than a hundred congregations were in existence. The congregation which was formed at Breslau is noticeable from the confession of faith which it issued, drawn up under the influence of Ronge, who had been chosen preacher. This confession completely departed from the doctrine and ritual of the Roman Catholic church. The Scripture was laid down to be the only rule of Christian faith, and no external authority, it was added, can be allowed to interfere with the free interpretation of it. The essentials of belief were restricted to a few doctrines: belief in God as the Creator and Governor of the world, and the Father of all men; in Christ as the Saviour, in the Holy Spirit, the holy Christian church, the forgiveness of sins, and eternal life. Baptism and the Lord's supper were held to be the only sacraments. Confirmation was retained, but most of the rites and practices peculiar to the Roman Catholic church were given up.

The need of something like concert being felt, the first council of German Catholics was held at Leipsic, March 22, 1845, and attended by deputies from many of the leading congregations, others signifying their willingness to abide by the decisions that might be come to. The principles of the Breslau confession were mostly adopted. The interpretation of Scripture, the only source of Christian belief, was left to the free exercise of reason, pervaded and actuated by the "Christian ideas." Forms of worship were to be adapted to the requirements of time and place. With regard to church government, the council declared in favor of the presbyterial and synodal constitution. The congregations were to have the free election of their clergy and eldership.

The effect of this union was to increase the number of congregations, which by the end of 1845 amounted to about 300. Numbers of leading Catholics, professors and others, joined the movement; and learned Prostestants, like Gervinus, looked upon it as a momentous event in the history of Germany. Individual Protestant clergymen went over to the body; and all those Protestants who, from dissatisfaction with the state church, had formed what are called "free" or independent congregations, entered more or less into relations with it. The local boards and magistracy also showed great favor to the cause, and often supported it by granting the use of Protestant churches, and even funds.

But German Catholicism was destined soon to find enemies both within and without. To say nothing of orthodox Catholics, conservative Protestantism began to suspect it as an undermining of religion in general, and dangerous to the welfare of "church and state." And as the movement fell in with the liberal tendencies of the times in general, the governments took the alarm, and set themselves to check its spread. Saxony took the lead, and Prussia soon followed, in imposing vexatious, and even tyrannical restrictions upon the "Dissidents," as they were styled by the authorities. In Baden, they were even denied the rights of burghers, while Austria, then pre-eminent in religious bigotry, sent them out of her territories.

It was more, however, internal disagreements than state persecutions that checked the prosperity of German Catholicism, as was to be anticipated from the wide discrepancy between the views of Czerski and those of Ronge. Czerski and his adherents held closely by the doctrines and ritual of Rome, and issued successive confessions, laying down more and more definitely the essential points of belief, such as the divinity of Christ, and other positive doctrines. Ronge's party, on the other hand, approached nearer and nearer to the Rationalists, and, leaving the province of religion altogether, occupied themselves with free-thinking theories and democratical politics. This led to numerous disagrements between congregations and clergymen, and discouraged the spread of the movement. When the second council was held in Berlin, in 1847, the interest had greatly declined.

When the great storm of 1848 burst, the German Catholics, as well as other bodies, had free space for their exertions, which, however, took mostly a political direction. Ronge was active in traveling and preaching, and although his free-thinking and political tendencies were repudiated by numbers of the body, they predominated in many places, and found expression in a series of publications, among others, in Rau's *Catechism of the Christian Religion of Reason*, and Schell's *Book of Religion*. After the political reaction set in, strong measures were taken against the German Catholics. The early enthusiasm of the movement apparently died out, and after the dissolution of the Frankfort parliament, Ronge retired to London. In 1850, a conference was held at Köthen between the German Catholics and the "Free Congregations" (*Freie Gemeinden*), an association of free-thinking congregations which had been gradually forming since 1844 by secession from the Protestant church. The immediate issue was a close confederation of the two bodies, followed in 1859 by an incorporative union of German Catholics and Free Congregations under the name *Association of Free-religious Congregations*. At this time the whole number of the congregations in the united body was 104; they received few subsequent additions, and are in a very unprosperous condition. See Kampe's *Geschichte des Deutsch-Catholicismus* (1860). For the *Old Catholic* movement in Germany, see DÖLLINGER.

GERMAN, COUSIN-. Cousins-germans, or first cousins are those who are related to each other by their fathers and mothers having been sisters or brothers, or the father or mother of the one being the sister or brother of the other. The term has no relation to German, in the sense of Teutonic, but comes from the Latin word *germanus*, which again is derived from *germen*, a young bud or branch. Cousins-german are, therefore, those who are the buds or branches of the same tree, and they have in reality always one grandfather in common.

GERMAN'DER (*Teucrium*), a genus of plants of the natural order *Labiatæ*, having the calyx tubular, 5-toothed and sometimes 2-lipped; the corolla with the upper lip very short and bipartite, the lower lip spreading and trifid; the stamens much exserted. The species are numerous, and very widely distributed. A few are natives of Britain. The COMMON GERMANDER or WALL GERMANDER (*T. chamædrys*), often found on ruined walls, has probably been introduced from the s. of Europe. It is a small, almost shrubby, perennial; with wedge-shaped ovate inciso-serrate leaves, and whorls of about three large reddish purple flowers. It is bitter, somewhat aromatic, and was formerly

much used in medicine, particularly in cases of gout. It was a principal ingredient in a once famous gout medicine called *Portland powder*.—Similar medicinal virtues were ascribed to *T. Botrys*, a small annual species common on dry hills in Germany; with aromatic fragrance and yellow flowers. WOOD GERMANDER or WOOD SAGE (*T. scorodonia*) is a very common British plant, growing in dry bushy or rocky places, with oblong-ovate very much wrinkled leaves, and one-sided racemes of yellowish-white flowers. It is very bitter and slightly aromatic. It is used in Jersey instead of hops.—WATER GERMANDER (*T. scordium*), a rare British species, growing in wet meadows, has a smell resembling that of garlic. It had once a great reputation in medicine.—CAT THYME (*T. marum*), a native of the s. of Europe, abounds in a pungent volatile oil, has a camphor-like smell, and—like catmint and valerian root—has great attractiveness for cats. It is often used as a sternutatory; and its powder snuffed into the nose has proved very beneficial in cases of polypus.—A species found in Cochin-China (*T. thea*) is used there in infusion as tea.

GERMA'NIA was the general name under which the Romans designated not only great part of modern Germany, but also a portion of Belgium and the n. and north-eastern districts of Gaul, the two last being more especially characterized as "Germania Prima" and "Secunda," while Germany proper was also called "Germania Magna," "Germania Trans-Rhenana," or "Germania Barbara." The boundaries of the region comprehended under these designations were—on the west, the Rhine and Celtic Gaul; on the e., the Vistula and the Carpathian mountains; on the s., the Danube; and on the n., the sea, which was divided by the Cimbrian Chersonesus (Jutland) into the German and the Suevic (Baltic) seas. The first occurrence in connection with the history of the people of Germania with which we are acquainted, was the appearance of warlike tribes of Cimbri and Teutones in the present Steiermark or Stiria, where they defeated the Roman consul Papirius, in the year 113 B.C. Eleven years later, they again came into collision with the Roman arms, but the result was their signal defeat by Marius. The names Germani and Germania do not seem to have been appellations in use among the people themselves, and it is probable that the Romans borrowed them from the Gauls or Celts, in whose language the word "gairm," a loud cry (like the Homeric *boèn agathòs*, "good at the war-shout"), may possibly have served to designate this people, whose habit it was to accompany their attack on an enemy by loud cries. The Tungri were the first German people that crossed the Rhine, but other tribes soon followed; and when Julius Cæsar opened his Gallic campaigns (58 B.C.), he found the Germanic nations of the Triboci, Nemetes, and Vangiones in possession of the districts lying between the left bank of the Rhine and the Vosges, while he even encountered a rival pretender to the supremacy of Gaul in the person of Ariovistus, the leader of the Suevic tribe of the Marcomanni. All these tribes were, however, finally reduced to subjection with the rest of Gaul, while the Tencteri and Usipetes, who had invaded Belgium, were driven, together with the Sicambri, across the Rhine to their former settlements by the victorious general, who for the first time (55 B.C.) led a Roman army into Trans-Rhenic Germany. The quiet which Cæsar's victories had secured in the Rhenish districts was again so seriously disturbed by the Usipetes and several of the neighboring tribes in the year 16 B.C., that Augustus, who had hastened to Gaul on the outbreak of disturbances, saw that stringent measures must be adopted to keep the Germans in check, and sent Drusus at the head of eight legions into Germany. The first step of the Roman general was to dig a canal ("fossa Drusiana") from the Rhine to the Yssel, by which the Roman galleys could sail from the heart of the continent to the ocean; and so successful were his measures, that in the course of four campaigns he had carried the Roman arms as far as the Albis (Elbe), subdued the Frisii, Batavi, and Chauci in the n., and defeated the Catti of the Moenus (Maine) districts. Drusus, who died 9 B.C., began the series of forts, bridges, and roads which were completed and extended under succeeding commanders. The attempt made by Varus, under the direction of Augustus, to introduce the Roman provincial forms of administration into Germany, brought, however, a sudden check to the advance and consolidation of Roman power; for the tribes of central Germany, indignant at this attempted subversion of their national institutions, ranged themselves under the leadership of Arminius, a chief of the Cherusci, who organized a general revolt. The result of this movement was the destruction, at the Saltus Teutobergiensis, of the three legions commanded by Varus, and the subsequent loss of all the Roman possessions between the Weser and the Rhine. The news of this disastrous event threw the city of Rome into consternation. Germanicus, who was sent forth in 14 A.D. to restore Roman supremacy, would probably have again wholly subjugated the Germanic tribes had he not been recalled by Tiberius in the midst of his victories. From this time forth the Romans ceased their attempts to conquer Germany, and contented themselves with repelling the incursions which the tribes made on their frontiers, and endeavoring by their influence to foster the intestine disturbances which were perpetually generated through the ambition and jealousy of rival leaders, such as Arminius, Marbodius, and the Goth, Catualda. After the murder of Arminius by his own people, the power of the Cherusci declined, while the Longobardi and Catti began to assert a recognized preponderance among the neighboring tribes. Occasional encounters took place between the people of central Germany and the legions who guarded the

well-protected Roman boundary-line, which extended from the Rhine to the Taunus, and from thence to the Danube; and from time to time the Batavii and other warlike tribes of the n. and n.w., who, like them, had been brought into partial dependence on the Romans, rose in formidable insurrection; but after Trajan had restored order and strengthened the forts, peace remained undisturbed in the n. till the beginning of the 3d c., while, with the exception of the sanguinary war of the Marcomanni and Quadi under Aurelius Antoninus in the year 166 A.D., there was a similar absence of hostilities in the south. But with the 3d c., the tide of war turned, and the Romans were now compelled to defend their own empire from the inroads of the numerous Germanic tribes, foremost among whom stood the powerful confederacies of the Alemanni and Franks. In their track followed, during the next two centuries, successive hordes of the Vandals, Suevi, Heruli, Goths, and Longobards, who soon formed for themselves states and principalities on the ruins of the old Roman provinces. From this period till the establishment of the western empire in the person of Charlemagne, the history of Germany is a blank; but the condition of the country when he entered on the possession of his German patrimony, showed that since the retirement of the Romans the lesser tribes had become gradually absorbed in the larger, for on his accession the land was held by a few great nations only, as the Saxons, Frisians, Franks, Suabians, and Bavarians, whose leaders exercized sovereign power within their own territories, and, in return for military services, parcelled out their lands to their followers.

The knowledge which we possess of the habits and government of the ancient Germans is principally derived from the commentaries of Cæsar, and the "Germania" of Tacitus; and imperfect as these sources of information are, they are infinitely less contradictory than the subsequent records of the earliest Christian times. According to the Roman historians, the Germans were a people of high stature, fair complexion, and red or yellow hair, endowed with great bodily strength, and distinguished for an indomitable love of liberty. The men delighted in active exercises and the perils of war, and the women, whose chastity was without reproach, were held in high esteem. Each master of a family had absolute power over those of his household. Their habitations were generally separate, and surrounded by their several stalls and garners; for although there were villages whose inhabitants made common use of the fields and woods surrounding them, the Germans seem to have preferred isolated and detatched dwellings to aggregate settlements. Towns and cities they long regarded with aversion, as inimical to personal freedom. In regard to their political organization, it would appear that several villages formed a "hundred," several hundreds one "gau," and several gaus one tribe. In each tribe the people were divided into four classes—nobles, freemen, freedmen or vassals, and slaves. The king or chief was elected from among the nobles; but his power was very limited, and the government of the several tribes seems to have been democratic rather than monarchical.

The religion of the Germans, which is shrouded in great obscurity, points, like their language, to their eastern origin, and was based upon Asiatic myths of the creation of the world, and the existence of gods having the forms and attributes of a perfect humanity. Their conceptions of these mythical beings were modified by the local coloring which they received from association with new scenes, and through the lapse of time; and hence the different tribes had all their special gods or demigods, who were often their own leaders or chiefs, to whom the attributes of the god to whose worship they were most partial were ascribed. It is generally said that the Germans had neither temples nor statues. Both Cæsar and Tacitus expressly affirm this, but it cannot be regarded as literally true, for Tacitus himself mentions a temple of a goddess Tanfana among the Marsians; and at a later period, we find Christian missionaries exhorting the Germans to change their pagan temples into Christian churches, while we also read of the destruction of pagan idols. Nevertheless, the religion of the Germans was mainly carried on in the open air—in groves and forests, and on heaths and mountains. Although a priestly order also existed among the Germans, yet each master of a household performed religious services for himself and his family within his own homestead. A knowledge of the will of the gods and the events of the future was sought by divination, from observations of the flight of birds, the rushing of waters, and other similar signs, in the interpretation of which women were thought to be especially skilled. Belief in a future life, and in an abode after death for those who had deserved well in this life, was cherished among the Germanic races, who had a strong faith in retributive justice, whose sway they believed would be extended over the gods by involving them in a universal annihilating conflict as the punishment of their evil deeds, after which a new world was to arise, guarded by a pure and perfect race of gods. In addition, to the higher deities, the Germans peopled every portion of space with a class of subordinate beings who pervaded the earth, air, and water, in the shape of elves, nixes, kobolds, dwarfs, and giants; while Nornes and Valkuries stood apart from either grade of spiritual existence as the representatives of destiny like the Moiræ and Parcæ of the Greeks and Romans.—See Kuhn, *Zur, ältesten Gesch. d. indogerman. Völker* (Berlin, 1850); Wackernagel, *Familienleben d. Germanen* (Freibr., 1846); Gibbon's *Decline and Fall of the Roman Empire;* Grimm, *Deutsche Mythologie* (1844); Müller, *Altdeutsche Religion;* the *Deutsche Mythologie* of Simrock (1855) and of Holtzmann (1874).

GERMAN'ICUS CÆSAR, a distinguished Roman general, belonging to the imperial family, was the son of Nero Claudius Drusus, and of Antonia, daughter of Mark Antony, and niece of Augustus. He was born 15 B.C., in the month of September. In accordance with the desire of Augustus, who had even thought of making him his successor, he was adopted in the year 4 A.D. by Tiberius, whom he accompanied in the war waged against the Pannonians and Dalmatians, for the purpose of securing the German frontiers after the defeat of Varus. After having been consul in 12 A.D., he was appointed in the following year to the command of the eight legions on the Rhine. On the death of Augustus, in 14 A.D., the soldiers revolted, demanding higher pay, and a shorter period of service. Germanicus hastened from Gaul (where he happened to be at the time) to remind them of their duty. The soldiers, who almost idolized him for his frank and generous disposition, urged him to seize upon the supreme power. Germanicus, however, was incapable of treachery, and declared that he would rather die than forfeit his allegiance. He, however, granted their demands, though his colleague, A. Cæcina, secretly massacred the ringleaders at night. Germanicus now led the legions over the Rhine below Wesel, attacked the Marsi during a nocturnal festival, and destroyed their celebrated temple of Tanfana. In 15 A.D., he made a second inroad into Germany. Proceeding from Metz into the country of the Catti, he destroyed their chief town of Mattium (Maden, near Gudensberg), slaughtering the entire inhabitants, young and old. On his return, his assistance was implored by the ambassadors of Segestes (always a firm ally of the Romans), who was besieged by his son-in-law, Arminius, the conqueror of Varus. This was at once given, and Thusnelda, the heroic wife of Arminius, fell into the hands of the Roman general. Arminius, burning with anger and shame, now roused the Cherusci and all the neighboring tribes to war. Germanicus, in consequence, commenced a third campaign. He divided his army into three divisions. The main body of the infantry were led by Cæcina through the country of the Bructeri, the cavalry under another general marched through Friesland, while Germanicus himself sailed with a fleet through the Zuyder zee into the German ocean, and proceeded up the river Ems, where he joined the others. The united divisions now laid waste the country in the neighborhood of the Teutoburg forest, penetrated into its gloomy depths, and gathering up the bones of Varus and his legions, which had lain bleaching there for six long years, buried them with solemn funeral honors. A victory gained by Arminius induced Germanicus to make a hasty retreat, during which he lost part of his fleet in a tempest. Cæcina, who retreated by land, sustained severe losses at the hands of the pursuing Germans. Before the fleet of 1000 vessels, which Germanicus had built in Batavia, was equipped, he was recalled over the Rhine in 16 A.D. by news of the beleaguerment of the recently acquired fortress of Aliso, on the Lippe. The Germans were repulsed, and the funeral mound in the forest of Teutoburg, which they had thrown down, was again erected. Germanicus now sailed with his fleet again into the Ems, pressed forward to the Weser, which he crossed, and completely overthrew Arminius in two battles. Nevertheless, he determined to return, and on his way, again lost the greater part of his fleet in a great storm. In order to prevent this event from giving courage to the Germans, he once more, in the same year, marched into the country of the Marsi, and despatched his lieutenant, Silius, against the Catti. The victories thus achieved were to have been followed up in the succeeding years, but Tiberius, jealous of his glory, recalled him, and feigning good-will, bestowed upon him the honor of a triumph, in which Thusnelda appeared among the captives. To rid himself of Germanicus, whose popularity seemed to render him dangerous, Tiberius sent him, in 17 A.D., with extensive authority, to settle affairs in the east, at the same time appointing Piso viceroy of Syria, whose haughty and despotic character everywhere counteracted the influence of Germanicus. Germanicus died at Epidaphnæ, near Antioch, 9th Oct., 19 A.D., probably of poison. He was deeply lamented both by the inhabitants of the provinces and the citizens of Rome, whether his ashes were conveyed, and deposited by his wife Agrippina in the mausoleum of Augustus. Agrippina herself and two of her sons were put to death, by order of Tiberius; her third son, Caligula, was spared. Of the three daughters who survived their father, Agrippina became as remarkable for vices as her mother had been for her virtues. Besides his splendid generalship, Germanicus was conspicuous for his magnanimity, benevolence, finely cultured understanding, and personal purity of life. He wrote several works of a rhetorical character, which have been lost; but of his poetical works, we possess an epigram, a version of the *Phænomena* of Aratus, and fragments of a work of the same character, entitled *Diosemeia*, or *Prognostica*, compiled from Greek sources. Germanicus's literary remains were first published at Bologna, in 1474. The latest edition is that of Orelli, at the end of his Phædrus (Zurich, 1831).

GERMAN IVY, a clinging plant often seen in parlor or garden culture, indigenous to southern Africa. It sometimes bears yellow flowers, and the stems grow 8 or 10 ft. high. It is well adapted to window culture.

GERMA'NO, SAN, or CASINO, as it is now generally called, a beautiful and prosperous town of Italy, at the base of Monte Casino, in the province of Caserta, about 50 m. n.n.w. of Naples. It contains handsome public edifices, and is surrounded by the remains of monuments and buildings of high antiquarian interest; it is built on the site

and from the ruins of the ancient Volscian town, Casinum, or Casca. The principal ruins of the ancient Volscian period are a monument, supposed to have been a tomb, an amphitheatre, and a temple. The first is now employed as a church; it is a square building, in the form of a Greek cross, constructed with enormous squared blocks of stone, on the Cyclopean principle. From its form, it is called the church of the Crucifix, or *Crocefisso*. The second must have been a magnificent building, and it is still in a state of preservation sufficient to convey an idea of its original vast proportions. The third, adjoining the amphitheatre, was probably built in conjunction with it, at the cost of the Volscian matron, Umidia Quadratilla, mentioned by Pliny. The Benedictine monastery of Monte Casino, at a couple of miles' distance from San Germano, is one of the most renowned religious communities of Europe. Its foundation by St. Benedict dates from 529. It contains one of the most beautiful churches of Italy, an extensive library, and a collection of the most precious documents of the middle ages in its valuable archives. The district surrounding San Germano is highly cultivated, and beautiful. Pop. about 10,000.

GERMAN OCEAN. See North Sea.

GERMAN PASTE, used for feeding birds such as larks, thrushes, nightingales, and other singing-birds, especially those which in their wild state feed chiefly upon insects. Take 2 lbs. pea-meal, ½ lb. of sweet almonds blanched, ¼ lb. of fresh butter or lard, 5 oz. moist sugar, ¼ dr. of hay saffron, and 8 eggs boiled hard. Beat them into a smooth paste, using sufficient water to give it the consistence required for granulating by passing it through a colander; then expose the granulated paste to the air in a warm place until it is quite hard and dry. If properly prepared and dried, it will keep good in a dry place for a year or more.

GERMAN PHILOSOPHY. When we speak of the philosophy of Germany, we do not necessarily imply that it differs from the philosophy of any other country in respect of the problems it seeks to solve, any more than when we compare the German chemistry with that of France or England. To characterise German philosophy, means nothing more than to point out the peculiar path that German thinkers have followed, and the degree of success that has attended their investigations, in seeking to answer those speculative questions which are understood to form the domain of philosophy, and which concern all men, if they concern any. Understood in this sense, German philosophy claims a high place—according to many, the highest. At least, for almost a century now, a more general interest has been taken in the cultivation of philosophy in Germany then elsewhere, and abstruse and deep speculation has been chiefly represented by German thinkers. That country has thus made up for the ground she lost by continuing to adhere to the traditional forms of scholastic philosophy after they had been forsaken in France and England. This spread of philosophic culture was coincident with the perfecting and adaptation of the German language to prose composition. For though Leibnitz confined himself, in his philosophical writings, to the Latin and French languages, Chr. Thomasius, about the same time, had begun to employ the mother-tongue both in academic lecturing and in writing, a practice which was extended by the numerous writings of Chr. Wolf. The expansion of German literature in the last half of the 18th c. completely emancipated speculation from the trammels of a foreign idiom, and alongside of a rich poetical literature there sprang up a philosophy which may claim comparison with that of Greece.

As regards the scientific characteristics German philosophy, it may be remarked that the systems put forth by Bacon in England, Descartes in France, and Spinosa in Holland, had but little influence in Germany at the time of their appearance. It was Locke that first awakened any considerable attention. The empiricism of this philosopher, who grounds all knowledge on experience and makes psychology the regulator of metaphysics, called forth the opposition of Leibnitz, the first German that made an epoch in the history of modern philosophy, and who, from the varied impulse he communicated, must be looked upon as the creator of the philosophic spirit in Germany. At the same time the fundamental doctrines of Leibnitz's system—that of monads, of a pre-established harmony, and of innate ideas—were rather genial hypotheses than regularly established propositions. To remedy this, Wolf endeavored to construct a system of philosophy complete in all its parts, as required by the forms of logic, in doing which, however, he set aside precisely those doctrines that formed the characteristics of Leibnitz's philosophy. The great influence exercised by Wolf is shown by the wide circulation of his writings, and the multitude of his disciples and adherents. Wolf himself, however, outlived his fame, and the original philosophic mind in Germany went to sleep for a period, during which a sort of eclecticism, without any fundamental principle—the so-called philosophy of "common sense," prevalent in England and France in the 18th c.—became generally spread. This period, however, was not without great intellectual excitement of other kinds. Poetry, reform in education, politics, and religious enlightenment, keenly occupied men's minds; old customs and associations, both in family and political life, were shaken; and preparation was silently going on for a great and radical revolution.

Kant, with whom the next period of German philosophy begins, thus found an age ready to receive impressions; and, although the *Kritik der Reinen Vernunft* (Critique of

the Pure Reason) was at first in danger of being overlooked, when a hearing was once obtained, that, and his other critical works, which, after long preparation, appeared in rapid succession, communicated a profound impulse to the scientific world. This arose, not more from the novelty and the comprehensiveness of his researches than from the circumstance that their aim fell in with the tendencies of the age. The exclusion of everything dictated by caprice or sentiment, the maintenance of the independence of speculative inquiry, the reference of all theoretical speculation to the field of experience accessible to it, and the elevation of the moral element to the highest and ultimate object of all human endeavor, form the leading traits of his philosophy, which he recommended consideration, more from its importance to man and society than to nature of the philosophers. He also entertained the hope that through the critical inquiry into the human mind, it might be possible to reconcile empiricism and rationalism, sensualism and spiritualism, and other philosophical opposites, and discover a series of comprehensive principles to which all philosophical disputes might be referred in the last resort. This hope was disappointed; among other causes, because Kant sought to ground the old metaphysic of the schools on a psychology which itself rested on the basis of that metaphysic. Besides, there was wanting in the heyday of Kantism any satisfactory point of unity for the several parts of philosophy. K. L. Reinhold was the first to point out this defect; and scepticism, as in C. Schulze's *Ænesidemus*, and dogmatism in the writings of Eberhard and others, carried on a war with the "critical" philosophy, but not, it must be confessed, with any great success. It was Fichte who found, or thought he had found, in the fact of consciousness, that absolute point of unity which Kant's "Critique" had always pointed to. Fichte, following out the path on which Kant had entered, changed the half-idealism of Kant into a complete idealism, by declaring the ego to be, not only the bearer and source of knowledge, but the only reality, the world being merely the ideas and active manifestations of the ego. In the ego, being and knowing were identical, it was at once existence and knowledge, and nature appeared only as the reflex of its absolute activity.

With this idealism began a kind of revolutionary excitement in the philosophizing minds of Germans which contrasted strongly with the calm and sober spirit of Kant. System followed system; philosophical books appeared in shoals; and for a quarter of a century and more the interest was shared by the public in general. But the meteors that appeared in the philosophical sky of Germany vanished, for the most part, as suddenly as they had blazed forth. Schelling was the first that attained a general influence. F. H. Jacobi had previously recalled attention to Spinosa, and Schelling, influenced by the speculations of Spinosa, converted the idealism of Fichte into what is called "the philosophy of identity." This system set out originally with the assertion, that as Fichte educes nature out of the ego, so, by an inverse process, the ego may be educed out of nature; but that both these forms of philosophizing have their ground in the *absolute* as the *identity* of all opposites—of the real and the ideal, of subject and object, of mind and matter. In carrying out this assertion, Schelling fixed upon intellectual intuition as the kind of cognition alone corresponding to the absolute, or rather, as identical with and representing the absolute. The organ of this intuition was called reason, and, as such, was opposed to the reflection of the understanding, which was held to be quite incapable of taking cognition of the absolute. The relation of the phenomenal world to the absolute was held to consist in this, that the absolute represents itself in the multiplicity of appearances, steps out of the state of "indifference" into that of "difference," manifests itself in "difference," etc. Taking special cases, particularly in natural philosophy, Schelling endeavored to demonstrate the existence of this identity in the midst of non-identity, and of non-identity in the midst of identity. In this attempt, however, neither Schelling nor his disciples effected much. For in undervaluing and neglecting experience and reflection, the door was opened to a fanciful mode of speculation, which in most cases had little more in common with science than the name; so that in the departments of poetry, religion, and social life, the Schelling philosophy often degenerated unto a blind groping, leading to the strangest aberrations of romanticism, mysticism, and tendency to Catholicism.

The philosophy of Hegel (q.v.) took the same general direction as that of Fichte and Schelling. Hegel attempted to develop, in regular organization, the contents of the intellectual intuition (in plain words, the cognitions and ideas of the mind) by the dialectic or logical method. Though he broke loose from the prevalent fashion of indulging in an unbridled play of fanciful combinations, he did not content himself with the rules of logic recognized for thousands of years, but sought an expression for speculative thought in a dialectic of his own. The essence of this transcendental logic consisted in the analysis of all the established general conceptions; and the process or method consists in making each conception of itself generate its opposite, and, combining with this opposite, thus become enriched and enabled to advance to still higher stages. This method Hegel, with enduring perseverance, endeavored to carry out through the whole field of philosophy; and divided his system into the three provinces of logic, philosophy of nature, and philosophy of mind.

While the systems above considered form pretty much a continuous line of progress, that of J. F. Herbart (q.v.), on the contrary, arose in opposition to the idealism of Fichte, and took a direction in complete antagonism to the dominant philosophy. The

well-nigh innumerable productions of other thinkers in this department, though often of individual merit, are only of secondary importance for the development of philosophy as a whole. None of them opened up any new leading path; they are occupied chiefly in defending or remodelling older systems, and applying them to particular departments of science, or in controversy with the dominant philosophy of the day. To this category belong the Kantian systems of Krug and others, the physical speculations of Steffens, Oken, Schubert, etc.; the various attempts to lead back philosophy to empirical psychology; the peculiar speculative attempts of Schleiermacher, J. J. Wagner, Fichte the younger, A. Trendelenburg, etc.; the different tendencies within the Hegelian school; and lastly, the position which Schelling latterly took up. The philosophy of Schopenhauer (q.v.) has had a peculiar fortune. Long known to but a very limited circle, it has, during the past twenty years, largely occupied attention, and has done more to reawaken an interest in philosophical speculation than any other system.

While philosophy during the last half century was thus actively prosecuted as a science, a corresponding interest was taken in its history; in fact, it was Germans who first sought to grapple with the history of philosophy as a whole, and to throw light upon the principal departments of it by valuable special treatises. See PHILOSOPHY. The rapid succession of systems, one after another, and the extravagancies into which some of them ran, have, it is true, produced a lull in the interest taken in speculation; and to the former enthusiasm there soon succeeded a skeptical aversion to all speculative inquiry. Still the influence that philosophy has had in elevating and strengthening the scientific mind of Germany, has been powerful and beneficial; and there are few departments of research in which the fruits of the philosophic spirit may not be seen in a deeper and more thorough mode of treatment.

GERMAN REFORMED CHURCH. See REFORMED CHURCH IN THE UNITED STATES.

GERMANS, ST., formerly the seat of the episcopal government of the ancient diocese of Cornwall, England, now a small village in the co. of Cornwall. It stands on the slope of a hill, on a branch of the river Lynher, 10 m. above Plymouth sound, and 21 m. e.s.e. of Bodmin. It is notable only for its fine parish church, which has an excellent Norman w. front, and the towers of which are hung with ivy and fern. Pop. '71, of parish, 2,678.

GERMAN SCALE IN MUSIC. This scale of the natural notes is A, H, C, D, E, F, G; not A, B, C, etc. The B is always reserved for B flat, and its place is supplied by substituting the letter H.

GERMAN SEVENTH DAY BAPTISTS. See BAPTISTS, SEVENTH DAY GERMAN.

GERMAN SILVER, the name given to an alloy formed of copper, zinc, and nickel. It is variable in its composition according to the requirements of the manufacturer, but may be stated, for general purposes, to consist of copper 50.0, zinc 30.0, nickel 20.0; this composition is very malleable, susceptible of high polish, and nearly as white as silver. This is used to imitate silver in articles which are rolled and stamped, and consequently require considerable malleability. By taking 55 parts of copper, 24.4 of zinc, and 20.6 of nickel, we obtain a very beautiful alloy, scarcely inferior in beauty to silver itself. For wire-drawing and very thin rolling, a tougher alloy is formed of copper, 60 parts; zinc, 25 parts; nickel, 20 parts; and for castings the following proportions are used—copper, 60 parts; zinc and copper, each 20 parts. Many other formulæ are in use arising from difference of opinion amongst the manufacturers as to the best proportions for their respective operations, usually, however, the aim is to obtain a silvery whiteness, and the largest proportion of malleability.

This alloy must not be confounded with other white alloys, such as albata, Britannia metal, and nickel silver, which are used as substitutes for the true German silver. The first of these is composed of copper, zinc, nickel, and a little lead; the second of copper, zinc, tin, antimony, and sometimes bismuth; and the third of copper, 60.0, nickel 22.2, zinc, 17.8. This last differs only in its proportions from the German silver; it has the color of highly polished silver, and is very hard. The color of German silver being so near that of the precious metal, it is particularly well adapted for plating, either by the old process of rolling with silver, or in the newer and now generally used process of electro-plating; the advantages are, that a thinner deposito f silver can be used, and the articles made not liable to the objection of the old process of plating on copper, which, as soon as the silver began to wear off, was rendered apparent by its red color.

As alloys of the nature of German silver are easily ozidized when brought in contact with free acids (as, for example, with the acetic acid contained in vinegar), and as the salts of lead, copper, and nickel that are thus formed are poisonous, it is nor expedient to use spoons, dishes, etc., composed of German silver.

The extent to which it is now used is very great indeed, and, combined with electro-depositing, it has been the means of adding immensely to the national industry, the manufacturers of Birmingham and Sheffield supplying every quarter of the globe with a profusion of articles of taste and utility in electro-plate in beautiful designs, and rivaling genuine silver-plate in beauty of appearance.

German silver derives its name from the fact that it was first made at Hildburghau-

sen, in Germany, where it was made by smelting the ores of the metals above-mentioned, and a small proportion of iron ore also; this last, however, is very rarely used now, although it adds to the silvery whiteness of the alloy, but it renders it more brittle.

GERMAN THEOLOGY. I. *Its new life.* At the period of the reformation in Germany, the spiritual life imparted through the instrumentality of the inspired word, produced a reconstruction of theological doctrine as well as of religious institutions and of moral practice. Belief in the Scriptures was no longer demanded on the authority of the church; her voice did not announce the canon or impose the interpretation. But the authority of the Scriptures as the rule of faith was acknowledged, because their doctrine of salvation by faith in Christ—which is their central life—manifested to the soul their divine power. "Christ is the emperor over the Scriptures; a writing that does not urge Christ cannot claim canonical authority." Faith, thus receiving the Scriptures as its rule, came out from the vast, imposing, and powerful system which had been consolidated as the Christianity of the middle ages, and essayed to re-establish the teachings of Christ, and of his apostles in his name. These teachings, as apprehended by the faith of the German Protestants, found expression in the Augsburg confession and apology, in Luther's catechisms, and the Schmalkald articles. In these, justification by faith is the center around which the system of doctrines is arranged, and from which they all derive their life.

II. *Its formal orthodoxy.* Following the reformation came a period of thought and struggle for the preservation and development of the doctrines received. The power of faith was exerted and tasked in the bloody conflicts which ensued on the reaction produced chiefly through the hidden agency of the Jesuits. The proofs of the truth of the reformation presented in the Scriptures and by the history of the church, had to be searched out and exhibited to view. The presentation and defense of doctrine, consequently, engrossed the attention of writers and preachers. At first this toil and conflict were far from being deficient in spiritual life. But the power spent in the conflict was not adequately sustained by new supplies; and the very effort to make the outward defenses strong, diminished the sense of dependence on the inward life. Consequently the inward life declined, and, with the decline, the whole system was changed. Justification by faith, although it was the central principle in which the life of the whole was contained, was regarded at length only as one of many doctrines, all of which seemed weak and ready to die. Orthodox theology, with all its apparent defenses, became like a massive citadel which, although it could not be stormed, might easily be taken while the defenders within were either dead or dying.

III. *Its season of pietistic revival.* This state of things was interrupted by a remarkable revival of practical religion which spread over Germany. It was commenced through the instrumentality of John Arndt, who (1605–1609) published, in four volumes, *True Christianity*—a book intended to arouse persons of all classes, but especially ministers and students, to practical and heartfelt religion, as well as to purify the corrupt morals of the age. It produced a powerful impression. No book on practical religion has been more widely diffused; not even (it is affirmed) the *Pilgrim's Progress* or the *Saint's Rest*. Its revivalism also awakened the opposition of the rigid and formal theologians. The movement thus commenced was greatly advanced by Spener (1635–1705). One of his pupils was A. H. Francke; Paul Gerhard also belonged to the party. They established religious meetings called "colleges of piety." This name led to the movement being called pietism. It spread rapidly through Germany, and, at first, without excitement or opposition. But as the effect increased, popular agitation was awakened and violent tumults arose which, beginning in Leipsic, extended through the Lutheran churches in the different states of Europe. And from this time, in all cities, towns, and villages where Lutheranism was established, there appeared suddenly persons, of various ranks and of both sexes, who declared that it was their mission to uproot iniquity, spread true religion through the world, and impart to the church of Christ wiser rules than those which then prevailed. In their writings, in public discourses, and private conversations they explained the means necessary for accomplishing their plans, which they proposed to do without introducing any change into the doctrine, discipline, or government of the Lutheran church. The university of Halle, founded by the friends of pietism, became its home and center. The orphan house, established in that city by Francke, was one of its most efficient instrumentalities, because a living proof that it was able, not only to resist religious error, but also to supply the gravest wants of life. During the 30 years after the university was founded, it educated 6,000 theologians. Its oriental college prosecuted diligently the study of the biblical languages, and sent out missions to Mohammedans and Jews. From Halle the new life was diffused over Europe. The larger cities showed signs of reviving faith, and even the universities which, at first, had violently opposed the movement, became its friends. Pietism was extended into Würtemberg and the university of Tubingen by the labors of Bengel, and into Moravia by those of Zinzendorf; Zurich, Basle, Berne, and many other large towns admitted it. It went as far e. as the Baltic and as far n. as Norway and Sweden. Many of the continental courts were influenced by it. Orphan houses like Francke's became fashionable. The reformed church was awakened; England and the Netherlands received the new movement with joy. Tholuck declares that "the Protestant church of Germany has

never possessed so many zealous Christian ministers and laymen as in the first 40 years of the 18th century."

IV. *The inroad of rationalism.* 1. *Its incipient advance.*—In the next generation, the fervor of pietism had abated. The diligent study of scriptural truth was exchanged for passive assent to it. Spener had endeavored to unite reason and faith, but his followers, renouncing reason, clung to faith alone. In this way pietism unintentionally, but really, exerted an influence against the orthodox system of doctrines by attaching great importance to the Bible alone as opposed to creeds, and to the witness of the spirit as opposed to the written word. Zeidler, an eminent minister at Leipsic, honoring the Bible, treated systems of doctrine with contempt. Some fervent mystics, in their zeal for the "inner word," spoke lightly of inspiration and atonement. Some insisted simply on Christian love and morality, heedless of danger from the assaults of false teachers. Koch (1754) lamented the low esteem into which the Bible had fallen among all classes of society. This pressure against orthodox doctrine at home was strengthened by influences coming from England and Holland, the force of which may be estimated by the opposition at first made to it, as indicated by the fact that, within 40 years, nearly 90 works were published against various phases of unbelief. 2. *The period of historical criticism.*—At the middle of the 18th c. German theology was in a rigid and shallow condition. The contest between pietism and formal orthodoxy had ceased. The second generation of professors at Halle had gone. The old defenders of orthodoxy had disappeared. Many of the preachers were engaged in collecting curiosities, stamps, and old coins. Just then the era of historical criticism was ushered in. New investigations were begun; antiquity, literature, science, were diligently explored; the circle of religious beliefs was thrown open for re-examination. Many of the results assumed to have been reached had afterwards to be abandoned; others are now admitted and accepted by all parties. On this field also, English deists had already been at work. Toland, Collins, Tyndall, Bolingbroke, had attacked the authenticity of the canon, insisting that the apocryphal books threw doubt also on the others; that many passages in the gospel were spurious; that the time at which the canon was settled is unknown; that the genuine sacred books of the Jews had perished during the exile.* Hobbes assigned reasons for rejecting the Pentateuch; Morgan presented the views of Toland and Bolingbroke in an attractive style; Collins assails the prophecies, asserting that only in Daniel are there real predictions, and strangely adding that even these "were written after the events." In Germany, Semler of Halle led the advance, obscuring with mist the old orthodox landmarks, assailing the text of the Bible, denying the relevancy of standard proof-texts, disputing the genuineness of many biblical books, and undermining usages and doctrines which, hitherto, all had received. The vigor of critical examination, thus awakened, spread rapidly among the universities and the clergy. It was employed on biblical criticism and exegesis, church history, and the history of doctrine. The authority of the church Semler, indeed, held fast, but in a singular manner, affirming that the symbols and forms are useful in preserving external unity and uniformity. His great error was in supposing that religion could exist without a doctrinal foundation. Beginning with the warmth of pietism around him, he gradually abandoned all reverence for the Scriptures. Regarding the inner conviction of a truth-loving human heart as the only test of the inspiration of a book, he rejected Ruth, Ezra, Nehemiah, Esther, and the Canticles; questioned the genuineness of Joshua, Judges, Samuel, Kings, and Daniel; and slighted the Pentateuch as a collection of legendary fragments. The New Testament, he thought, was better than the Old, yet some of its parts he condemned as positively evil. The Apocalypse he rejected as the work of a fanatic; the Gospel of John he distinguished as the only one *useful* for the modern church He asserted that Christ and the apostles taught many things in mere accommodation to the prejudices of the age. The doctrines of the Bible Semler vigorously attacked. One after another of the most important seemed, for a time, to be overwhelmed by his stroke. And what he did at Halle, other bold men did in different parts of Germany. Two writers, especially, carried out their principles both in their books and in their lives. Edelmann constructed his theological system in answer to the question—*not what is true, but what is useful?*—that is, what is seen to be useful? Consequently, beginning with very slight departures from orthodoxy, he reduced Christianity, at last, to a weak form of deism. "The reality of everything which exists is God. The world may be called the body of God, the shadow of God, the son of God. The spirit of God is in all that exists. It is foolish to ascribe inspiration to special persons only; every one ought to be a Christ, a prophet, an inspired man." Bahrdt went much further, ridiculing the Bible, blaspheming Christ, and, by his immoral life, making the very name of theologian infamous. Yet he stands as the turning-point of vulgar rationalism. It had become manifest that criticism, if left to itself, would produce only destruction. And this compelled the search for something that would avert the fall. At the opening of the 19th c., the Scriptures, rationally interpreted, were still regarded as teaching a rational religion. But as the historical exegesis had advanced, the chasm had widened between the traditional and the rational sense. The accommodation theory was increasingly applied to every portion of the Bible, and, at length, the mythical theory began to appear. Baur, in 1800, published a Hebrew mythology of the Old and New Testaments, in which the miracles were explained away as merely natural events.

8. *The connection of rationalism with philosophy.*—The work of preparation for rationalism had at first been prompted by the demands of what was called "the sound human understanding;" but after the opening of the 18th c., the aid of philosophy also was sought. Leibnitz's distinction between doctrines which can be rationally proved and those which are above reason was used to cast suspicion on the latter class. Wolff proposed a division of theology into natural and revealed; and, as natural theology could give the reason for the facts which it affirmed, and revealed could not, emphasis was put chiefly on the former. After the decline of Wolff's popularity, the criticism of Semler and his followers seemed harmonious enough with the eclectic system which, for a time, prevailed; for both the criticism and the philosophy were in accordance with the demands of "the sound human understanding." But Kant's philosophy assailed both. Some of the rationalists, indeed, claimed it as favorable to them; others slighted it as unintelligible; but a few more discerning men saw that the new would overturn the old. When the speculative systems of Fichte and Schelling appeared, they despised the reasonings of "the sound human understanding," and slighted the best principles of rationalism as commonplace and vulgar. And rationalism, on its part, shrinking back from the new atheism, wrote strongly against it. In the faith-philosophy of Jacobi the rationalists thought they could find refuge. Their scheme, hitherto, had allowed no scope to sentiment and the heart. A mere probability was its highest word for the essential truths. The system of Jacobi met this difficulty, since to the intellectual probability it added the certainty of feeling. Therefore the better class of rationalists welcomed it. With this rose also the supernaturalist school, including those who denied the absolute rule of reason in matters of religion; and, though many of them were deficient in reverence for the Bible, they were, at least, travelers in an upward path. Hegel and his followers professed to furnish "an equivalent for the objects of Christian faith and the propositions of Christian theology in the dogmas of their system. The latter were said to be the pure and final rendering of that which Christianity presents in a popular form. The trinity, the atonement, and the other doctrines of the orthodox creed had now—it was asserted—received a philosophical vindication, and the vulgar rationalism, which had flippantly impugned these high mysteries, was at length laid low." This high claim, Strauss, in his life of Jesus, utterly denied. Treating the gospels as a narrative of merely natural events, he asserted that Jesus, a devout man, impelled, like other Jews, by the preaching of John the Baptist, made confession of sin and was baptized. Afterwards, proclaiming himself as the promised Messiah, by his courage, activity, and purity of life, he won the good opinion of many, especially of the common people, and attached to himself a company of devoted disciples; but having, by his scathing rebukes of hypocrisy, kindled the enmity of the priests and Pharisees, he was, by their influence, put to death on the cross. The wonderful works of beneficence and power, with which the narrative was adorned, were only fanciful inventions of his disciples, which ultimately came to be regarded as facts. This historical Jesus, Strauss strove to transform into an ideal character, and affirmed that the God-man is to be looked for not in any one person, but in the human race as a whole. At a later period he was driven to admit, for a time, that the life of Jesus was extraordinary; that Jesus himself had controlling power over the minds of men, and perhaps over physical disease; that "in him must be recognized the highest that can be known or thought in religious things; that without him present in the mind no complete piety is possible, so that the substance of Christianity is in him preserved to us." But these admissions he again withdrew, regretting that in making them he had nicked his sword.

V. *Return to evangelical doctrine.* As the way for the prevalence of rationalism had been opened through the decline of practical religion, so the return to evangelical doctrine was effected by a revival of personal piety, the central line of which can be traced in the lives and work of a series of eminent men. While Semler was striving to disintegrate faith in the Scriptures, as well as the Scriptures themselves, Klopstock wrote and published his *Messiah*, which was spread over every part of Germany and among all classes, awakening admiration, kindling devotion, and drawing the hearts of thousands to the person of the Redeemer. About the same time, Hamann, a young German, after vainly seeking relief in folly and vice from the effects of disappointment, retired to a remote part of London, obtained a Bible and read it carefully. His mind was enlightened to see his past life in its true character and he entered at once on a new course. His writings and genius soon procured him friends in his own country, and gave him influence over the noble, the gifted, and the rich, by which they, as well as men of humbler life, were won to the Christian faith. Herder, contemporary with both Klopstock and Hamann, in his *Spirit of Hebrew Poetry*, gave attention particularly to the literary and human elements of the Bible as, in his opinion, strengthening its claims to a divine origin. He pointed out, critically, its poetical beauties, not as if they were ornaments only, but as springing from the heart of the revelation and forming an essential accompaniment of inspiration. He wrote also on the New Testament, treating of the Pentecostal gift of tongues, the resurrection, the Redeemer in the three gospels, the Son of God as the Savior of the world, and the spirit of Christianity. While imparting elevated views of the Scriptures, he labored also to exalt the pastor, considering that his true place was by the side of the old prophets and that no man was worthy of the office who neglected the particular care of souls. He was himself, in many respects, a model

preacher. "When he began to speak every sound was hushed and each curious glance fixed on him; all hearts opened themselves, tears filled every eye, and sighs escaped from every breast." While the three distinguished men above mentioned were in the midst of their active work, Schleiermacher was born, who has been called the greatest divine of the 19th c., and to whose influence for good, scarcely any limit can be assigned. In his 15th year he was sent to a Moravian school, whence he brought a personal devotion to Christ which guided him through life and sustained him in death. His *discourses* to unbelievers of cultivated minds, published in 1799, marked at once the opening of a new century and of a new era in religion. "To him religion was the feeling of an absolute dependence on God, a consciousness of sin, and of the redemption by Christ. All philosophical terms and definitions, all physical investigations, all theses whatever that could not be derived by strict inference from the profound feeling of sinfulness and the certainty of redemption were excluded from his system of doctrines." In 1789, David Mendel was born of poor Jewish parents, his father a peddler, his mother an intelligent and pious woman. At Hamburg he was assisted in acquiring an education, and soon won the respect of teachers and scholars by his talents, while he excited also their merriment, by the oddity of his appearance and the awkwardness of his manner. When Schleiermacher's *Discourses* were published, he was one of the multitudes awakened by them, and in 1806, renouncing Judaism, he was baptized and took the name Neander (a new man). He studied theology at Halle, where Schleiermacher was his favorite professor and deeply interested friend. In 1812 both teacher and pupil were made professors in the new university at Berlin, the former, of theology, the latter of church history. In this position Neander worked to the end of his life and acquired, as a lecturer, vast renown. Even Schleiermacher's hearers were limited in number when compared with the crowds that came from all parts of Germany, and the most distant Protestant countries, to hear Neander. Many Roman Catholics also were found in his classes. All the great preachers of Germany became more or less enlightened by his ideas. His salutary influence on the religious condition of the country was immeasurably great, powerfully contributing to the overthrow both of rationalism and of dead formalism, and drawing multitudes of young men to embrace the vital doctrines of Christianity. With him religion was nothing without Christ—Christ not only apprehended by the intellect, but also loved and trusted with all the powers of the soul. In his view sin was not only injurious, but also involved guilt, and could be pardoned only through the death and mediation of Christ. In 1816 Tholuck entered the university of Berlin where he was rescued from scepticism under the instructions of Schleiermacher and Neander, aided by the influence of a distinguished Moravian friend. During serious illness the ardor of his love to Christ was kindled and he adopted Zinzendorf's motto—"I have but one passion—that is He, and He alone." In 1826 he became professor of theology at Halle as the successor of prof. Knapp who had sincerely but timidly resisted the prevalent rationalism. Out of 900 students only five avowed their belief in the divinity of Christ; and all the professors, being rationalists, opposed Tholuck's appointment. But the number of young believers in Christ increased year by year. Tholuck, at first alone among his colleagues, won the field for Christ; and they all, one by one, came over to his side. Many thousands of young men became Christians under his instructions. And, among the honored instruments by whom Germany has been turned from rationalism to Christian faith, Tholuck will ever hold an eminent place. Hengstenberg, born 1802, devoted his youth chiefly to the study of philosophy and the oriental languages; but, during a season of sickness and sorrow, having turned with great ardor to the spiritual teaching of the Bible, he became fully convinced of the divine authority of evangelical religion and of the excellence with which its truths are expressed in the Augsburg confession. In 1826, he was made one of the professors of theology at Berlin, and. from that time, for more than 40 years, was a conspicuous and earnest defender of Christian doctrine, as based on the divine authority of the Scriptures. Among his numerous writings may be mentioned, as having especial influence: *Egypt and the Books of Moses; Commentary on the Psalms;* and *The Christology of the Old Testament.*

In recent years, the political discussions in Germany have tended to produce in the public mind, especially of the common people, a theological indifferentism unfavorable to evangelical faith. The rising opposition to an ecclesiastical government works temporarily to the disfavor of the Christian doctrines which, as sustained by the rational church, are, in the view of many, identified with it.

GERMAN TINDER. See AMADOU.

GE'RMANTOWN, formerly a post-borough of North America, in the state of Pensylvania, about 6 m. n.n.w. of Philadelphia, within the chartered limits of which city it was included in 1854, See article PHILADELPHIA.

GERMANTOWN, a suburb of Philadelphia, since 1854 included within the 22d ward of the city; pop. of the ward, '70, 22,605. It was laid out, under a grant from William Penn, in 1684, and at first, as its name indicates, settled by Germans, its center being about 6 m. from the state house, in a n.w. direction. During the war of the revolution, Oct. 3–4, 1777. Washington made a forced march all night, and surprised a part of the army of the British gen., Howe, which was encamped across the Germantown

street. The surprise was complete, as the Americans entered the town about sunrise, and were concealed by the early fog; but they were themselves thrown into confusion by the many small inclosures of the village, and, being seized with panic, fled, carrying away their artillery, but suffering a loss of about 1,000 men. The British loss was about 600. The main street, extending n.n.w from the city, is now built up for a distance of about 4 m., and is intersected by many other streets. Germantown contains 21 churches, a number of high and other schools, a bank, and several extensive manufactories. It is the residence of many wealthy citizens, and is lighted with gas, and well supplied with water, and connected with the city by horse and steam railways.

GERMANUS, Saint, 380–449; b. in (Auxerre) Gaul, of an eminent family; learned in literature and law and distinguished for eloquence. He was military governor of his native district, afterwards bishop of Auxerre. Being chosen bishop, he separated from his wife, built a monastery, and devoted his spare property to the poor. He visited England twice, and on one occasion led the Britons against a plundering party of Picts and Scots, terrifying them into a retreat by shouting "Hallelujah," from which circumstance the event was called the "Hallelujah Victory." He encouraged St. Patrick to undertake the conversion of the Irish. His feast occurs on July 31. Three or four lives of St. Germanus have been published.

GERMAN WINES. The culture of the vine is almost confined to southern and western Germany, and especially to the Rhine district. The northern limits of its growth extend from Bonn in a north-easterly direction, through Cassel to the southern foot of the Harz, crossing 52° n. lat. on the Elbe, running then e. some m. to the n. of that parallel, and finally turning sharply towards the s.w. on the Warthe. In the valley of the Saale and Elbe (near Dresden), and in Lower Silesia (between Guben and Grünberg) the number of vineyards is small, and the wines of inferior quality; but along the Rhine, from Basel to Coblentz, in Alsace, Baden, the Palatinate and Hesse, and above all, in the province of Nassau the lower slopes of the hills are literally covered with vines. Here are produced the celebrated Rudesheimer, Hochheimer, and Johannisberger. The vines of the lower Main, particularly those of Würtzburg, are the best kinds; those of the upper Main and the valley of the Neckar are rather inferior. The Moselle wines are lighter and more acid than those of the Rhine. The total amount produced in Germany is estimated at 1000 million gallons—Alsace-Lorraine turning out 400 millions, Baden 175, Bavaria, Wurtemberg, and Hesse, together, 300, while the remainder, which, though smaller in quantity, is in quality the best, is produced by Prussia.

The wines of Alsatia are similar to those of the Palatinate; they are white and the principal vines are the Riessling, Traminer, Burger, or Elbing, and Grosser Räuschling. The Sylvaner and Rulānder are also to be found, but peculiar to the district is the Knipperle which fills the vineyards of Thann, Rickweiher, and Ribweiler. The vines produced are consumed in the district, and in the adjoining parts of Switzerland. They were formerly added to Rhenish products of the lower districts to make them milder, but now the reverse obtains. The vineyards of Gebweiler, Türckheim, Rickweiher, Ribweiler, Thann, Bergholtzell, Ruffach, Pfaffenheim, and others yield dry white vines of very good quality, ranking in the second class. The best liqueur wines are made at Colmar, Kaisersberg, Olweiler, Ammerschwihr, Kiensheim, and a few other places. The vinicultural districts of the Palatinate are situated at the foot of a mountain called the Haardt which is the continuation towards the n. of the Vosges. The 70.000 fuder (a fuder=246¼ gallons) of wine which are produced in this district, form about one-tenth of the total production of wine in the south of Germany, and it is celebrated for its medium good quality, the purity and freshness of its taste, and the extreme relative lowness of its price. The mode of training the vine here is that called the "double-chamber cultivation," and extends from Landau to Maikammer. The prevailing vines are the Gutedel, Traminer, Sylvaner, and the Riessling. The superior quality of wines are Ruppertsberger, Deidesheimer, Wachenheimer, and Forster; Ungsteiner, Dürkheimer, and Königsbach, belong to the second class. The wines and vines of Rhenish Hesse are similar to those of the Palatinate. Liebfraumilch, a Riessling wine of fine bouquet, is produced in one of the vineyards of Worms. The district of Oberingelheim produces much red wine of the second and third class from Burgundy grapes, and furnishes considerable quantities for the production of *mousseux*, particularly to a celebrated manufactory at Rüdesheim. The district of Bingen is distinguished by the growths of Scharlachberg and Feuerberg. The wines of Laubenheim, Guntersblum, Nierstein, and Selzen possess individual reputations, and are often substituted for wines of the Rheingau. The country anciently called Franconia, which is now comprehended under the name of the lower circle of the Main of Bavaria, contains about 70,000 Bavarian tagwerke of vineyards, equal to 58,912 acres. Only a small quantity is exported, and that is grown in the neighborhood of Würtzburg. The best vineyards are the Leiste, Stein, Middle Stein, the Harp and Schalksberg, and the wines in good years have a particular strength.

Würtemberg and Baden produce considerable quantities of wine, but as its quality is rarely above the fourth class, none is exported. The area of the vineyards is 51,532, Baden morgen, 45,848 acres; the quantity of wine produced annually exceeds 500,000 ohms; its value is estimated to vary between seven and eleven millions of florins. Growths of reputation are the white Markgräfler, and the Affenthaler, a light, agreeable

red wine. The area of the vineyards of Würtemberg is 54,600 Morgen—42,528 acres, of which more than half are situated in the valley of the Neckar. The average money value of the annual product is only three and a half millions of florins. Much of the wine has a pale red color, and hence is termed "schiller." Hesse, n. of the Main, produces wine in the valley of the Kintzig, from Hanau to Gelnhauser.

The country between the Taunus mountains on the n., and the river Rhine on the s. is generally known as the Rheingau. Its eastern terminus is near Schierstein and Walluf, a short distance below Mayence; its greatest width from n. to s., amounting to 3 m., is at Steinberg and Hallgarten, and its western termination is at the Wisper, below Assmannshausen. In conjunction with the Rheingau we consider the district of Hochheim which has furnished the monosyllabic English term "hock" by which all Rhine wines are confused. Hochheim is situated upon the northern bank of the Main, about 3 m. e. of Mayence. The Riessling is the characteristic and all-pervading vine. The Elbing, Traminer, green Orléans, or Rüdesheim Orleans, and the black Burgundy, or the Pineau, are also cultivated to a limited extent. The dominant white-graped vine is the Kleinberber, a variety of the Elbing, or Ximenes grape. The best vineyard of Hochheim is the Dechanei or deanery, which is 10 morgen in extent. The Stein is the eastern continuation of the Dechanei, and yields vines which are sometimes said to surpass the best Steinberg and Rüdesheim products. The best vineyards of Ellfeld, or Eltville, are the upper and middle Sonnenberg; then follow the Sterzel, and Narrow Way, which are situated lower and more towards the village. The south-western side of the ridge passes into a valley which runs towards Rauenthal, and here are the favored positions of Münchnach, and the Gray Stone. The vineyards of Rauenthal are situated upon the side of a long hill. The e. of the hill is termed Nonenberg and Rothenberg. The best situations have a southerly and south-westerly exposure, such as Gehren and Kesselring, and the Wisshell. The Geierstein is the extreme end of the good positions. The vineyards of Kiedrich are situated about 3 m. from the Rhine. The principal situation is the Graefenberg, and the Mittelberg. The Steinberg is the most famous vineyard of Germany, and is now public property of Prussia. It is a hill about 3 m. distant from the Rhine, and covers a surface of about 80 morgen. There is a farm at the foot of the vineyard, which is kept for the sole object of producing the necessary manure. The Steinberg has various undulations and hollows, by which it is divided into districts yielding a different produce. Of these, three are particularly famous, namely, the Golden Beaker, the Garden of Roses, and the Pländzer. The latter yielded the best piece of cabinet wine in the famous year 1819. There are many villages at the foot of the mountains with good vineyards, such as Halgarten and Vollraths. The celebrated Marcobrunner grows close to the Rhine between Erbach and Hattenheim. Stretching for some distance westward of Hattenheim there are some excellent vineyards, and passing Oestreich, Mittelheim and Winkel, the entire country is undulating until it reaches the Johannisberg. This entire flat basin is an enormous vineyard, 6 m. long and 3 m. broad. The Riessling vine predominates, but considerable Elbing is cultivated in the lower parts.

The Johannisberg is a conical hill projected from the Taunus mountain to within about a mile of the river Rhine. The six morgen of vineyards at the foot of the southern declivity, termed the Klausenberg, have only a feeble inclination, and produce the least valuable wine, while the Langeberg and especially the Oberberg produce excellent wine. There are 62 morgen of vineyards, which are manured by the entire produce of a large farm. It is claimed that a bottle of mature Johannisberg Castle is, by the fullness of its taste and the mass of its bouquet, the finest and most powerful drink on earth. From the Johannisberg towards Geisenheim extends a declivity, the best situations of which are termed Morschberg, Lickerstein, and Hoher Rech. Near Geisenheim the Rothe Berg, or red hill, projects, which produces some splendid wine. The vineyards of Rüdesheim begin at Eibingen and terminate at the Bingerloch. The vineyards nearest to Eibingen are called the Wüste, Bokhaus, and Tafel, the higher situation towards the forest in the n., the Oberfeld. The vineyards nearest Rüdesheim are termed Hinterhaus. The contiguous Rottland is an undulating territory. The greater part of the Rüdesheim vineyards is called the Rüdesheimer Berg. This has an area of 400 morgen and is the best situation in Rüdesheim. The vines cultivated are Riessling, with a sprinkling of Orleans.

The banks of the Rhine from Assmannishausen to Coblentz have many vineyards, but no very good situations. The names of the villages producing wine are Bacharach, Manubach, Caub, Oberwesel, Steeg, Diebach, Weinsberg, Damscheid, Perscheid, Langscheid, and Dellhofen. These cultivate Riessling, often mixed with the small-berried Elbing, and in other parts some Pineau is grown.

The Moselle issues from the western slopes of the Vosges, and unites with the Saar near Trier. It then runs nearly north-ward with many windings, and flows into the Rhine near Coblentz. Its undulating banks in Lorraine, like those of the Saar, are covered with vines, and most frequently with the blue Burgundy grape, but its banks from Trier to Cochem bear white grapes principally. The Elbing occurs along the whole Moselle, and frequently prevails over the Riessling which is everywhere mixed with it. At Piesport, Brauneberg, Oligsburg, Zeltingen, and Trarbach there are vineyards with nothing but Riessling. Much red wine is grown at Piesport, Kersten,

Cobern, Cochen, Carden, and a few other places of the lower Moselle. The general character of Moselle wine is that of thin Rhine wine, but owing to the natural want of flavor, the producers of Moselle have devised an artificial flavor from the tincture of the flowers of the elder shrub. The sparkling Moselle has a great reputation. Much of it is made at Coblentz, and large quantities are also manufactured from Rhine wine at Mayence.

The vine is largely cultivated in Austria, and yields annually about 200–300 million gallons. The larger part of its wines, however, is used for home consumption. Of the wines of lower Austria those of Vöslau and Gurmpoldskirchen, in the neighborhood of Baden, have, during the last 40 years, obtained some reputation. The red wine produced in them comes from a particular black grape, called the early blue Portugese. That part of the Tyrol which produces wine is situated along the valley of the Adige. beginning near Verona, and running by Botzen up to Meran. The varieties of the grapes cultivated in the Tyrol are, in the Italian part, entirely Italian; in the German part, the Vernatch, a black muscatel, and a variety which the Germans call Geschlafene; also a grape called Tirolinger, or Trollinger, prevail.

The cultivation of the vine in Styria extends from Steinbrück, along the Save, and from Cilli by Hohennegg, Gonolütz, and Windischfeistritz to Marburg, the vineyards in the mountains called Bacher being particularly extensive. Hence, viniculture extends in the direction of Pettau and Fridau, into the most celebrated district, namely, the mountain of Luttenberg. Radkersburg and Windischbüchlen complete the enumeration of the wine-growing districts of Styria. Red wine is produced in only two parts, the Vinaric mountain near Gonovritz, running to Cilli, and in the Sausal mountain. Of the white wines, those of Luttenberg, Kirschbach, and Pickern belong to the better class. Among the vines are to be found Illyrian, Hungarian, a few Italian and French, as well as German vines, but some are quite peculiar to Styria and supposed to be indigenous. The climatic situation of Croatia is particularly favorable to viniculture. A high mountain forms its northern limit, from which many higher or lower ranges of hills run towards the south into the plain, but the mode of cultivation is defective. The prevailing vines are the Grünhainer and Heunisch. Like Croatian wine, the Dalmatian, when mixed with its own bulk of water, gives a fluid which is darker than the darkest Burgundy or Vöslau; they are mostly sold, and transported by ships to Italy. In Istria there is a vinicultural district between Trieste and Pirano, and another near Rovigno and Pola. The island of Vaglia, Cherso and Lussin also produce wine. The varieties of wines cultivated near Trieste are all Italian, among which are the blue Refosco and the white Malvoisie. The fruit of Görtz is excellent, but the wine is very mediocre. An effervescent wine, however, called Ribola, is in some demand. and there are large manufactures of a sweet wine called Picolet, which is sold to Turkey and Russia.

The best wine of Bohemia is that of Melnik, a town situated about 12 m. n. of Prague. It is made from the black Burgundy grape. There are about 3,915 Austrian joch of vineyards in Bohemia, of which each produces about 13 eimer of wine, an eimer being equal to 54 liters.

Hungarian wines.—A great variety as well as a large quantity of wine is produced in Hungary. It yields annually about 400 million gallons. It may conveniently be divided into five wine-growing districts. The northern district, on the left bank of the Danube, and includes the valley of the Waag, in which vines are cultivated from Trentschin to Szered; and also the valley of the Gran. It is mainly characterized by the Hegyalja mountain, containing the celebrated vineyards of Tokay and Erlau, and the less distinguished but fertile vineyards of the Bodrog, which flows from the Carpathian mountains, and the Samos, which issues from Transylvania. The eastern district, between the Theiss on the west and the river Samos and Transylvania on the east, produces the wines of Erdöd, Bakator, and Menes. The central district is between the Danube and the Theiss; its northern limit is at Pesth, and in the south it ends at the Woiwodina. The western district is divided into two parts—one west of the river Raab is represented by the vineyards of Rust; the other east of the Raab is characterized by the wines of Ofen, Somlau, and Weissenburg. The southern district includes the Banat and Woiwodina, the former contains the Werschitz mountain, and includes the Weisskirchen Banat.

The two dominant vines peculiar to Hungary are the Furmint or Tokay with white grapes, and the Kadarka with black grapes. In the county of Baranye there are some extensive plantations of Burgundy pineau, and around Villary there is much of the Rhenish Riessling, the early Portugese, and the Oporto vine. All varieties of wine called Ausbruch and Maszlacz, including the Tokays, Rust, Menes, and many others, are made by fortifying a quantity of must from plump grapes by means of "dry berries." There are five classes of Tokay. The first is Essence, which is very sweet, with a slight amount of alcohol. When fifty years old it is sold from $5 to $15 a bottle; the others are Ausbruch, Maszlacz, Szarmorodmy, and Ordinari. Karlowitz, in Syrmia, produces the Vermouth liqueur, and the Slibovitz or plum brandy, besides red and white Ausbruch wine. See Wine, *ante*.

GERMANY, from Lat. *Germania* (q.v.), is the English name of the country which the natives call Deutschland, and the French L'Allemagne. See Alemanni The word is sometimes used to denote the whole area of the European continent within which the

Germanic race and language are dominant. In this broad sense, it includes, besides Germany proper, parts of Austria, Switzerland, and, perhaps, even of the Netherlands; but in the present article the name is to be understood as denoting the existing Germanic empire, of which Prussia is the head. Germany occupies the central portions of Europe, and extends from 6° to 22° 40′ e. long., and from 49° 7′ to 55° 50′ n. lat. It is bounded on the n. by the German ocean, the Danish peninsular, and the Baltic; on the e. by Russia and Austria; on the s. by Austria, Italy, and Switzerland; and on the w. by France, Belgium, and the Netherlands. The population in 1875 was 42,757,812. Its area is estimated at 208,000 sq.m., or about $\frac{1}{18}$th of that of all Europe. The coast-line measures about 950 miles. Germany is composed of an aggregation of different states (26 in number), which, as they are specially treated of under their respective heads, will only be noticed in the present article in as far as they severally form parts of the Germanic empire.

The following list gives the names of these states, with the number of members representing each in the bundesrath or federal council, and the reichstag or imperial diet. The pops. and areas of the states will be found under EUROPE, under GERMANY, and under the head of each specially.

States of the Empire.	Number of Members in Bundesrath.	Number of Deputies in Reichstag.
Kingdom of Prussia	17	236
" " Bavaria	6	48
" " Würtemberg	4	17
" " Saxony	4	23
Grand-duchy of Baden	3	14
" " Mecklenberg-Schwerin	2	6
" " Hesse	3	9
" " Oldenburg	1	3
" " Saxe-Weimar	1	3
" " Mecklenburg-Strelitz	1	1
Duchy of Brunswick	2	3
" " Saxe-Meiningen	1	2
" " Anhalt	1	2
" " Saxe-Coburg-Gotha	1	2
" " Saxe-Altenburg	1	1
Principality of Waldeck	1	1
" " Lippe-Detmold	1	1
" " Schwartzburg-Rudolstadt	1	1
" " Schwartzburg-Sondershausen	1	1
" " Reuss-Schleiz	1	1
" " Schaumburg-Lippe	1	1
" " Reuss-Greiz	1	1
Free town of Hamburg	1	3
" " Lübeck	1	1
" " Bremen	1	1
Reichsland of Alsace-Lorraine	1	15
Total	59	397

Besides the above political divisions, there are certain distinctive appellations applied to different parts of Germany, which have been derived either from the names and settlements of the ancient Germanic tribes, or from the circles and other great subdivisions of the old empire. Thus the name of "Swabia" is still applied in common parlance to the districts embracing the greater part of Würtemberg, southern Baden, south-western Bavaria, and Hohenzollern; "Franconia" to the Maine districts of Bamberg, Schweinfurt, and Würtzburg; the "Palatinate," Rhenish Bavaria and the north of Baden; "the Rhineland," to portions of Baden, Rhenish Prussia, Bavaria, Hesse-Darmstadt, and Nassau; "Voigtland," to the high ground between Hof and Plauen; "Thuringia," to the districts lying between the upper Saale and the Werra, as Saxe-Weimar, etc., "Lusatia," to the eastern part of Saxony; "East Friesland," to the country between the lower Weser and Ems; and "Westphalia," to the district extending between lower Saxony, the Netherlands, Thuringia, and Hesse, to the German ocean.

Four-fifths of the population of this country are of the race called, in English, Germans, in French, Allemands, but by the people themselves Deutsche. The term Deutsch, in Gothic, *thiudisk*, in O. H. Ger. *diutisc* (Latinized into *theotiscus*), is derived from the Gothic substantive *thiuda*, people, and therefore meant originally the popular language, or, in the mouth of the learned, the vulgar tongue. In the 12th and 13th centuries, it became elevated into the accepted designation both of this wide-spread tongue and of the race that speak it.

The *Almanach de Gotha* for 1878 divides the population of the German empire, in regard to nationality, as follows: Germans, 37,800,000; Poles, 2,450,000; Wends, 140,000; Czechs, 50,000; Lithuanians and Courlanders, 150,000; Danes, 150,000; French and Walloons, 230,000. Among the first of these must be included half a million of Jews.

The Germans admit of being divided into High and Low Germans; the phraseology of the former is the cultivated language of all the German states; that of the latter, known as *Platt-Deutsch*, is spoken in the north and northwest. The Poles are found exclusively in the east and north-east of Prussia; the Czechs, in Silesia, about Oppeln and Breslau; the Wends, in Silesia, Brandenburg, and Prussian Lusatia; the Lithuanians and Courlanders, in east Prussia; the Danes, in Slesvig; the Walloons, about Aix-la-Chapelle, in Rhenish Prussia; and the French, partly in the same region, and partly in the newly re-acquired provinces of Alsace and Lorraine. Although the Jews are scattered over every part of Germany, they are most numerous in the Prussian territories.

Physical character.—Germany presents two very distinct physical formations. 1. A range of high table-land, occupying the center and southern parts of the country, interspersed with numerous ranges and groups of mountains, the most important of which are the Harz and Teutoburgerwald, in the n.; the Taunus and Thuringerwald, in the middle; and the Schwarzwald and Rauhe Alps, in the s.; and containing an area, including Alsace and Lorraine, of 110,000 square miles. 2. A vast sandy plain, which extends from the center of the empire n. to the German ocean, and including Slesvig-Holstein, contains an area of about 98,000 square miles. This great plain, stretching from the Russian frontier on the e. to the Netherlands on the w., is varied by two terrace-like elevations. The one stretches from the Vistula into Mecklenburg, at no great distance from the coast of the Baltic, and has a mean elevation of 500 to 600 ft., rising in one point near Danzig to 1020 ft.; the other line of elevations begins in Silesia and terminates in the moorlands of Lüneburg, in Hanover, its course being marked by several summits from 500 to 800 ft. in height. A large portion of the plain is occupied by sandy tracts interspersed with deposits of peat; but other parts are moderately fertile, and admit of successful cultivation.

In respect of drainage, the surface of Germany belongs to three different basins. The Danube (q.v.) from its source in the Schwarzwald to the borders of Austria belongs to Germany, and through this channel the waters of the greater part of Bavaria are poured into the Black sea; thus opening up communication with the east. By far the greater part of the surface, however (about 185,000 sq.m.), has a northern slope, and belongs partly to the basin of the North sea, and partly to the basin of the Baltic. The chief German streams flowing into the North sea are the Rhine (q.v.), the Weser (q.v.), and the Elbe (q.v.); into the Baltic, the Oder (q.v.) and the Vistula (q.v.).

The most important of the numerous canals which connect together the great river systems of Germany, are Ludwig's canal in Bavaria, which unites the Danube and Maine, and thus opens a communication between the Black sea and German ocean; the Finow and Friedrich-Wilhelm's canals in Brandenburgh; the Plaue canal, which connects the Elbe and the Havel; and the Kiel and Eyder canal, uniting the Baltic and German ocean. Numerous lakes occur both in the table-land of southern Germany and in the low lands of the northern districts, but few of them are of any great size. Germany abounds in swamps and marsh-lands, which are especially numerous in the low northern districts. Its mineral springs occur principally in Nassau, Würtemburg, Baden, Bavaria, and Rhenish Prussia. Many of these springs have retained their high reputation from the earliest ages.

Geology.—The great plain of North Germany consists of strata of the same age as the tertiary strata of the Paris basin, covered with very recent sand and mud. Newer tertiary beds occupy the river basin of the Rhine n. from Mayence; they consist of fine light-colored loam, and contain the the bones of the mammoth, rhinocerous, and other contemporaneous mammals. Erratics are scattered over the n. of Germany. The whole district in the center of Germany, from the Danube northwards to Hanover, consists of secondary strata. The rocks of the trias period are best known in Germany, the typical rocks of bunter sandstein, muschel-kalk and keuper being developed here, so as to justify the suitableness of the name trias, which is wholly inapplicable in Britain, where the series is represented by sandstone beds only. The trias is highly fossiliferous, abounding especially in marine shells, and containing several genera of remarkable labrynthodont saurians. Jurassic rocks occur in central Germany; at Hanover they consist of clays and marl, with beds of sandstone and limestone, containing coal and ironstone of such value that they have been extensively wrought. The cretaceous strata are frequently highly altered from the intruded igneous rocks, which have raised the beds in some districts to a nearly vertical position, and have altered them into crystalline marbles and silicious sandstones.

Of the palæzoic rocks, the carboniferous strata are nearly absent in Germany. The coal obtained in the country is from rocks of a later age. True coal-beds are found in Rhenish Prussia. The sedimentary rocks of the Harz mountains are chiefly Devonian; to the s.e., near Herzgerode, they are upper Silurian. They are all greatly dislocated by granite and other intrusive rocks. The Harz mountains are surrounded by a zone of permian rocks. The stratified rocks of the Thüringerwald are also Devonian, resting on lower Silurian strata, the lower portion of which is highly altered into quartzose schists; the remainder consists of greywacke, slate, and sandstone, with limestone and alum slates. There are numerous fucoid and annelid impressions in the older beds, and graptolites, orthoceratites, and trilobites in the newer.

The basltic rocks, trachytes, and other volcanic products are largely developed in

the Eifel, Siebengebirge, Westerwald, Vogels, Rhöngebirge, and other mountain systems of central Germany.

Climate.—The climate of Germany presents less diversity than a first glance at the map might lead one to infer, for the greater heats of the more southern latitudes are considerably modified by the hilly character of the country in those parallels, while the cold of the northern plains is mitigated by their vicinity to the ocean. The average decrease in the mean temperature is, in going from s. to n., about 1° F. for every 52 m., and in going from w. to e., about 1° F. for every 72 miles. The line of perpetual snow varies from 7,200 to 8,000 ft. above the level of the sea. The mean annual fall of rain is 20 inches. The following table shows the mean annual records of the temperature at different points of the continent:

	Mean An. Temp.	Summer.	Winter.
Hamburg	47.° Fah.	64° Fah.	30° Fah.
Dresden	48.	67	29
Frankfort-on-the-Main	48.5	66	31
Berlin	46.5	66	27
Hanover	48.	63	33
Königsberg	43.	62	24

Products.—Germany is rich in mineral products, among which the most important are silver, found in the Harz mountains; iron in numerous mountain-ranges; salt in many parts of the country; coal in Rhenish Prussia and Silesia. Cobalt, arsenic, sulphur, saltpeter, alum, gypsum, bismuth, pumice-stone, tripoli-slate, kaolin, emery, ochre, and vitriol, are all among the exports of Germany. The vegetable products comprise a very large proportion of the European flora. All the ordinary cereals are extensively cultivated in the n., and largely exported, chiefly from Würtemburg and Bavaria; hemp and flax, madder, woad, and saffron, grow well in the central districts, where the vine, the cultivation of which extends, in suitable localities, as far n. as 51°, is brought to great perfection, the best wine-producing districts being the valleys of the Danube, Rhine, Maine, Neckar, and Moselle, which are, moreover, generally noted for the excellence of their fruits and vegetables. Tobacco is grown in sufficient quantities for extensive exportation on the Upper Rhine, the Werra, and Oder. The hops of Bavaria have a high reputation, and the chicory grown in that country and in the district between the Elbe and Weser, finds its way all over Europe as a substitute for coffee. The most extensive forests are found in Central Germany, and in some parts of Prussia, while the north-western parts of the great plain are deficient in wood, the place of which is in some degree supplied by the abundance of turf yielded by the marshy lands. Germany has long been noted for the good breed of horses raised in the northern parts of the continent; while Saxony, Silesia, and Brandenburg have an equal reputation for their sheep-flocks, and the fine quality of the wool which they yield. The rich alluvial flats of Mecklenburg and Hanover are celebrated for their cattle; the forests of Northern and Central Germany abound in swine, and in small game of various kinds; while the Bavarian Alps afford shelter to the larger animals, as the chamois, the red deer and wild-goat, the fox, marten, and wolf; and in all the plains in the n., storks, wild-geese, and ducks are abundant. Among the fishes of Germany, the most generally distributed are carp, salmon, trout, and eels; the rivers contain also cray-fish, pearl-bearing mussels, and leeches. The oyster, herring, and cod fisheries constitute important branches of industry on the German shores of the Baltic and North sea. Germany stands next to Great Britain in regard to the care and success with which its agricultural, mining, and other natural capabilities have been cultivated. All the German states encourage agriculture, and have endeavored, by the establishment of agricultural colleges and exhibitions, to diffuse among the people a knowledge of recent scientific appliances. The countries which have become most conspicuous in this movement are Prussia, Bavaria, and Saxony. The preservation and cultivation of woods receive almost as much attention in Germany as agriculture, and like the latter, are elevated to the rank of a science. The larger woods and forests in most of the states belong to the government, and are under the care of special boards of management, which exercise the right of supervision and control over all forest lands, whether public or private.

Manufactures.—The oldest and most important of the German industrial arts are the manufactures of linen and woolen goods. The chief localities for the cultivation and preparation of flax, and the weaving of linen fabrics, are the mountain-valleys of Silesia, Lusatia, Westphalia, the Harz, and Saxony (for thread-laces); while cotton fabrics are principally made in Rhenish Prussia and Saxony. The same districts, together with Pomerania and Bavaria, manufacture the choicest woolen fabrics, including damasks and carpets. Toys, wooden clocks, and wood-carvings, which may be regarded as almost a speciality of German industry, are carried to the greatest perfection in the hilly districts of Saxony, Bavaria, and the Black forest. The best iron and steel manufactures belong to Silesia, Hanover, and Saxony. Silesia probably possesses the finest glass manufactories; while Saxony and Prussia stand pre-eminent for the excellence of their china and earthen wares. Augsburg and Nürnberg dispute with Munich and Berlin the title to pre-eminence in silver, gold, and jewelry work, and in the manufac-

ture of philosophical and musical instruments; while Leipsic and Munich claim the first rank for type-foundries, printing, and lithography. The trading cities of Northern Germany nearly monopolize the entire business connected with the preparation of tobacco, snuff, etc., the distillation of brandies, and the manufacture of sugar from the beet, potato, and other roots; while vinegar and oils are prepared almost exclusively in central and southern Germany.

Railways, etc.—The railways which intersect each other in all directions, from Basle on the Rhine to Hadersleben in the n. of Slesvig, and from Bautzen in the e. of Saxony to Aix-la-Chapelle in the w. of Rhenish Prussia, measured, in 1875, about 16,500 English m.; but these figures strictly represent the length, not of the lines within the limits of the German empire, but of those which are under German administration, though extending some way into neighboring states.

The various telegraphic lines of the empire (excepting those of Bavaria and Würtemberg) are now under a central administration, and in the end of 1874, the whole measured about 25,000 English miles.

The postal system of the German states, which is administered by boards of control, includes the expedition of passengers and goods by the post-carriages of the several departments. Since 1851, in accordance with a treaty concluded between Austria and Prussia, a Germano-Austrian postal union has been established, the objects of which are to secure an effective and more energetic administration of the various branches of the organization and the adoption of a uniform scale of charges, while it likewise exercises the duty of concluding international postal treaties with foreign states. Bavaria and Würtemberg have still their special postal administrations.

The multiplicity of small states, into which the German land was long broken up, opposed great obstacles to the development of commerce; but the difficulty was to some extent obviated by the establishment of the *Zoll und Handels-verein* (q.v.), or "Customs and Trade Confederation," and partly also by the absorption of several of the smaller states by Prussia.

Education.—Education is more generally diffused in Germany than in any other country of Europe, and is cultivated with an earnest and systematic devotion not met with to an equal extent among other nations. There are 21 universities: Berlin, Breslau, Halle, Bonn, Griefswald, Münster, Munich, Würtzburg, Erlangen, Leipsic, Tübingen, Göttingen, Heidelberg, Freiburg, Marburg, Giessen, Jena, Rostock, Kiel, Königsberg, and Strasburg. These institutions embrace the four faculties of theology, law, medicine, and philosophy; and in June, 1875, had 1729 professors and teachers, and 16,359 students. Of the 21 universities of the empire, 14 are Protestant, i.e., in the department of theology, they teach only Protestant theology; four are Roman Catholic. viz , Freiburg, Munich, Münster, and Würtzburg; three, viz., Bonn, Breslau, and Tübingen, are mixed, Protestantism prevailing in the first two, and Roman Catholicism in the last. There are also 16 polytechnic institutions; about 500 high schools or gymnasia; numerous special schools of technology, agriculture, commerce, military science, etc.; several seminaries for teachers, and for the ministers of different religious denominations; and more than 50,000 elementary schools. The attendance of children at school, for at least four of five years, is made compulsory in nearly all the German states, and hence the proportion of persons who cannot read and write is exceedingly small in Germany.

Public libraries—of which there are more than 150—museums, botanical gardens, art-collections, picture-galleries, schools of music and design, and academies of arts and sciences, are to be met with in most of the capitals, and in many of the country towns, upwards of 200 of which possess one or more permanently established theaters. In no country is the book and publishing trade more universally patronized than in Germany. The press annually sends forth from 8,000 to 10,000 works, while about 3,000 papers and journals are circulated throughout the empire; of the current newspapers, a comparatively small number only exert any marked influence, but many of the German scientific and literary periodicals enjoy a world-wide reputation. The censorship of the press was abolished by a decree of the diet of 1848, and freedom of the press, under certain restrictions, which were promulgated in 1854, has been introduced.

Army and Navy.—1. *Army.*—By the constitution of April 16, 1871, the Prussian obligation to serve in the army is extended to the whole empire; article 59 prescribes that every German who is *wehrfähig*, i.e., "capable of bearing arms," must be in the standing army from his 21st to his 28th year. Of these 7 years, 3 must be spent in active service (*bei den fahnen*), and the remainder in the army of reserve. On quitting the army of reserve, he has to form part of the *landwehr* (q.v.) for other five years. Article 63 enacts that *die gesammte Landmacht des Reichs wird ein einheitliches Heer bilden, welches im Krieg und Friden unter dem, Befehle des Kaisers steht*, ("the whole land forces of the empire shall form a united army, in war and peace, under the command of the emperor.") The sovereigns of the principal states have the right to select the lower grades of officers, but even their selections require to obtain the approval of the emperor, whose authority is paramount; article 64 expressly declaring that *alle deutschen Truppen sind verpflichtet den Befehlen des Kaisers unbedingt Folge zu leisten* ("all German troops are bound to obey unconditionally the orders of the emperor.") In August, 1875, the imperial army, on its peace-footing, consisted of 148 regiments of infantry, includ-

ing the guards; 26 battalions of jäger, or riflemen; 93 regiments of cavalry; 49 regiments of artillery; 19 battalions of engineers; and 18 battalions of military train, comprising a total of 18,079 officers, 401,659 rank and file, 97,379 horses, and 1200 guns. On its war-footing, the numbers were, in 1878, 31,843 officers. 1,283,791 rank and file, 301,536 horses, and 2,550 guns.

2. *Navy.*—The formation of a German navy, due to the initiative of Prussia, dates from 1848, and of late years rapid progress has been made. In Nov., 1875, the imperial fleet consisted of 62 steamers, 11 of which were iron-clads (5 turret-ships), 14 frigates and corvettes, 29 gunboats, and 7 avisos or despatch boats, with a total tonnage of 80,580 tons; and of 4 sailing-vessels, having a tonnage of 2,762. In 1876, there were 11 iron-clads, 18 corvettes, 22 gunboats, 11 torpedo boats, 23 transports, 6 avisos, 8 vessels serving as barracks, 5 pilot boats, etc. The fleet was manned in 1878 by 5,800 seamen and boys, and officered by one admiral, 1 vice-admiral, 3 rear-admirals, 61 captains, and 200 lieutenants. The total sea-faring pop. of Germany is estimated at 80,000, of whom 48,000 are serving in the merchant navy at home, and about 6,000 in foreign navies. The empire has 3 ports of war: Kiel (q.v.) and Dantzig (q.v.) on the Baltic, and Wilhelmshaven (q.v.) in the Bay of Jahde on the North sea.

Religion.—In regard to religion, it may be stated generally that Protestantism predominates in the n., and Roman Catholicism in the s., although very few states exhibit exclusively either form of faith.

The following is the proportion of the different denominations, according to the census of Dec., 1871: Protestants (Lutheran and Calvinist), 25,500,000; Roman Catholics, 15,000,000; various small Christian sects, as Herrenhuters, Mennonites, etc., 110,000; Jews, 440,000.

Political Organization.—All the states of the empire recognize four distinct orders—viz., the nobility, clergy, burghers, and peasantry, and all distinguish three distinct grades of nobility. The highest of these includes the members of reigning houses, and the descendants of families who belonged at the time of the old empire to the sovereign nobility of the state, and were *reichsunmittelbar*, or directly connected with the empire, as holding their domains directly under the emperor, but whose houses have subsequently been *mediatized*, or deprived of sovereign power in accordance with special treaties between the state and the princes. There are at present 50 princely and 51 *gräfliche* (countly) mediatized families, who, in accordance with the act of the diet of 1806, have equality of rank with reigning houses, and enjoy many of the special privileges which were accorded to the high nobles of the empire. The second grade of nobility is composed of counts and barons not belonging to reigning or mediatized houses, whilst the third and lowest grade includes the knights and hereditary patrimonial proprietors of Germany.

Before we proceed to consider the political organization of the new Germanic empire, we will briefly describe—1st, the principal features of the constitution of the old Germanic empire, which was overthrown by the first Napoleon in 1806; and 2d, that bund or federal government which lasted from 1814 to 1866, when Austria was excluded from the confederation, and the hegemony of Germany was transferred to Prussia.

The old Germanic empire.—The states of this empire comprised three chambers or colleges: 1. The electoral college, which consisted of the archiepiscopal electors of Mainz, Treves, and Cologne; and the secular electors, of whom there were originally only four, but whose number was subsequently increased to five, and, who at the dissolution of the empire, were represented by the sovereigns of Bohemia, Bavaria, Saxony, Brandenburg, and Brunswick-Lüneburg or Hanover (see ELECTORS). 2. The college of the princes of the empire, who had each a vote in the diet, and were divided into spiritual and temporal princes. 3. The free imperial cities which formed a college at the diet, divided into two benches, the Rhenish with 14 cities, and the Swabian with 37; each of which had a vote. These colleges, each of which voted separately, formed the diet of the empire. When their respective decisions agreed, the matter under discussion was submitted to the emperor, who could refuse his ratification of the decisions of the diet, although he had no power to modify them. Ordinary meetings were usually summoned twice a year by the emperor, who specified the place at which the sittings were to be held, and which, during the latter periods of the empire, were at Regensburg (Ratisbon). The diet had the right to enact, abrogate, or modify laws, conclude peace and declare war, and impose taxes for the general expenses of the state. The Aulic chamber, and the cameral or chief tribunal of the empire, decided in cases of dispute between members of the diet. The emperors were chosen by the electors in person or by their deputies; and after their election and coronation, both of which usually took place at Frankfurt-on-the-Main, the emperor swore to the 'capitulation' or constitution of the empire. After the dissolution of the empire, in 1806, its place was nominally taken by the confederation of the Rhine, which owed its existence to Napoleon, and which lasted till 1815.

Late Germanic confederation.—The late Germanic confederation was established by an act of the congress of Vienna in 1815, on the overthrow of Napoleon. It was an indissoluble union, from which no single state could at its own own pleasure retire. Its central point and its executive and legislative powers were represented by the federative

diet, which held its meetings at Frankfurt-on-the-Main, and was composed of delegates from all the confederate states chosen, not by the people, but by the various governments. The diet deliberated either in a limited council (the federative government) or as a general assembly (*plenum*). In the limited council there were 17 votes, of which 11 of the principal states had each a single vote, while the remaining states divided the six collective votes between them. The plenum, which met only when any organic change was to be effected in the diet itself, embraced 70 votes, of which Austria and the five German kingdoms had each four, while the other states had 3, 2, or 1 vote each, in proportion to their individual importance. It rested with the limited council, which executed the enactments of the plenum and dispatched the ordinary business of the confederation, to decide (by a majority of voices) whether a question should be submitted to the plenum, where it was not debated, but simply decided by a majority of ayes or noes. Austria presided in both assemblies, and had a casting voice in cases of equality. The diet, as a collective body, had the right of concluding peace and alliances, and declaring war; but this power could only be exercised for the maintenance of the independence and external security of Germany, and the individual integrity of the several federative states, which on their part were bound to submit to the diet the consideration of all questions in dispute between themselves and other powers. Where such differences could not be settled by the committee empowered by the plenum to consider them, they were finally referred to a special tribunal known as the 'Austrägal' court, which was composed of several members of the confederation invested for the time with full powers. For a full account of the proceedings which broke up this bund, and of the North German confederation which practically too its place, from 1866 to 1871, see article GERMANY.

New Germanic empire.—The seventy-ninth article of the constitution of the North German confederation provided for the admission of the South German states into the new bund; and the war between France and Germany, which broke out in July, 1870, and in which all the German princes and the peoples took part, gave an irresistible impetus to the desire for national unity. On Nov. 15, 1870, the grand-duchies of Baden and Hesse joined the bund; Bavaria followed on the 23d, and Würtemberg on the 25th of the same month. Shortly after, the king of Bavaria wrote a letter to the king of Prussia, urging him to re-establish the German empire. This brought the question under the notice of the bund; and on Dec. 10, 1870, it was agreed, by 188 votes to 6, that the empire should be restored, and that the king of Prussia should be acknowledged hereditary emperor of Germany. The latter solemnly accepted the new dignity at Versailles, Jan. 18, 1871.

The new empire is composed, like the old bund, of a confederation of German states; but these are welded into one, for national purposes, as was never before the case; and the imperial power, by the terms of the constitution, is so fully asserted, that it cannot possibly be assailed or questioned from within. There are two legislative bodies in the empire—the *bundesrath*, or federal council, the members of which are annually appointed by the governments of the various states; and the *reichstag*, the members of which are elected by universal suffrage and ballot for a period of three years. All imperial laws must receive the votes of an absolute majority of both bodies, and, to be valid, must, in addition, have the assent of the emperor, and be countersigned when promulgated by the *reichskanzler*, or chancellor of the empire, who is, *ex-officio*, president of the bundesrath.

According to the eleventh article of the constitution, the German emperor, with the consent of the bundesrath, can declare war, make peace, enter into treaties with foreign nations, and appoint and receive ambassadors. If, however, the territory of the empire is attacked, he does not require the consent of the bundesrath to declare war, but can act independently.

The power exercised by the empire extends to everything necessary to the security and welfare of the German people. The preamble to the constitution expressly declares that all the states of Germany *schliessen einen ewigen Bund zum Schutze des Bundesgebiets, und zur Pflege der Wohlfahrt des Deutschen Volkes* ("form an eternal union for the protection of the territory of the bund, and for the care of the welfare of the German people"). Thus, it possesses the exclusive right of legislation on all military and naval affairs; on imperial finance and commerce; on posts, telegraphs, and railways, in so far as the interests of the national defense are concerned. Wherever the laws of the empire come into collision with those of particular states of the bund, the latter must be held as abrogated, and in all disputes that arise among the latter, the imperial jurisdiction is supreme and final.

Acting under the direction of the chancellor of the empire, the bundesrath, in addition to its legislative functions, represents also a supreme administrative and consultative board, and as such, has seven standing committees—namely, for army and naval matters; tariff, excise, and taxes; trade and commerce; railways, posts, and telegraphs; civil and criminal law; financial accounts; and foreign affairs. Each committee consists of representatives of at least four states of the empire; but the foreign affairs' committee includes only the representatives of the kingdoms of Prussia, Bavaria, Saxony, and Würtemberg.

See *Handbuch d. Geog. und Statist.* v. Dr. Wappäus (Leip. 1859); *Geogr.-Statist.-Hist.-*

Atlas der Staaten d. Deutsch. Bund v. Weiland (1828); H. Berghaus, *Ethnograph.-Statist.-Darstellung des deutschen Reichs* (Gotha, 1848); Schauenburg, *Flusscharte v. Deutschl. und Mittel-Europa* (Berlin 1855); Stieler's and Spruner's *Atlases;* Baedeker's *Handbooks;* Von Klöden's *Erdkunde* (Berlin, 3d ed. 1873 *et seq.*); the *Statistik des Deutschen Reiches* (1873–79); Neumann's *Das Deutsche Reich in Geographischer, Statistischer und Topographischer Beziehung* (1872–74); the *Statesman's Year-book* and the *Almanach de Gotha* for the current year.

German History.—After the gradual expulsion or retirement of the Romans from Germany, the country necessarily became subdivided into numerous petty states, each governed by its own chief. The erection of the Franko-Merovingian empire in France had given preponderance to the Frankish power on both sides of the Rhine, and when Charlemagne succeeded, in 771, to the German as well as the Gallic possessions of his father, Pepin d'Heristal, he found himself possessed of an amount of territory and a degree of influence which speedily enabled him to assert supremacy over the whole of the w. of Germany, while his conquests over the heathen Saxons in the n., and the Avari who then held Pannonia in the s.e., extended his German dominions from the North sea to the Alps, and from the Rhine as far as Hungary. With Charlemagne, who received the imperial crown at the hands of the pope in 800, began the long line of emperors and kings who occupied the German throne for more than a thousand years; and with him, too, the vast fabric, which he had reared on the ruins of Roman power, lost its stability, for at his death in 814, no member of his family was competent to wield the imperial scepter, although in 843 some portions of his German possessions fell, in accordance with a family compact, to his grandson Ludwig, surnamed "the German," who was recognized as king of Germany. On the extinction, in 911, of the degenerate Carlovingian dynasty in the person of Ludwig "the child," the provincial rulers, who, together with the archbishops, bishops, and abbots, constituted the chief members of the diet or national assembly, arrogated to themselves (in imitation of the practice of the nobles of the ancient German tribes) the right of electing their sovereign, who, however, could not assume the imperial title till he had been crowned by the pope. At this period, there were in Germany five nations—the Franks, Saxons, Bavarians, Swabians, and Lorrainers. The Franks, as the descendents of those who had conquered the land and founded the empire, enjoyed a pre-eminence over the others; and hence, on the extinction of the Carlovingian race, the choice of the prince-electors seems to have fallen, almost as a matter of course, on the chief of the Franks, the duke or count of Franconia, who reigned as king of Germany from 911 to 918, under the title of Conrad I. At his own instigation, his rival and adversary, Henry, duke of Saxony, was chosen as his successor, and proved himself an able and warlike prince. The conquests which he gained over the Danes, Slaves, and Magyars were confirmed and extended by his son and successor, Otho I. (936–973), who carried the boundaries of the empire beyond the Elbe and Saale, and who, by his acquisition of Lombardy, laid the foundation of the relations which existed for many ages between the rulers or Germany and the Italian nation. Otho's coronation-festival was eventful, as it formed the precedent for the exercise of those offices which, till the dissolution of the empire, were regarded as connected with the dignity of the secular electors, for on that occasion, while the emperor dined with his three spiritual electors, he was waited upon by the secular princes—the elector of Bavaria (afterwards Saxony) serving as grand-marshal; of Swabia (afterwards Bohemia), as grand-cupbearer; and of Lorraine (afterwards Brandenburgh), as arch-chamberlain.

Otho II. (973–983), Otho III. (983–1002), and Henry II. (1002–1024), belonged to the house of Saxony, which was succeeded by that of Franconia, in the person of Conrad II. (1024–1039), an able ruler, who added Burgundy to the empire. His son and successor, Henry III. (1039–1056), extended German supremacy over Hungary, part of which he conquered and annexed to Lower Austria, while he repressed the insolence and despotism of the temporal and spiritual princes of Germany, and gained the respect of his contemporaries by his zeal for justice and his valor in the field. The minority of his son and successor, Henry IV. (1056–1106), enabled the nobles to recover much of their former power, and to apply a check to the further consolidation of the imperial authority, which had been considerably extended under the two preceding reigns. Henry's constant quarrels with the astute Gregory VII. entangled him in difficulties and mortifications which only ended with his life, and which plunged Germany into anarchy and disorder and entailed upon the empire destructive wars which convulsed the whole of continental Europe for more than two centuries. With his son and successor, Henry V. (1106–1125), the male line of the Franconian dynasty became extinct; and after the crown had been worn (1125–1138) by Lothaire of Saxony, who made a bold attempt to recover some of the prerogatives of which, at his election, the empire had been deprived through papal intrigues, the choice of the electors, after a season of dissention and intrigue, fell upon Conrad III., duke of Franconia, the first of the Hohenstauffen dynasty (1138–1152). His reign, in which the civil wars of the Guelphs and Ghibellines began, was distracted by the dissensions of the great feudatories of the empire, while the strength of Germany was wasted in the disastrous crusades, in which Conrad took an active part. On his death, the electoral college for the first time met at Frankfurt, which retained the honor of being the place at which the sovereign was elected and crowned till the dissolution of the empire in the 19th century. Frederick I. (1152–1190),

surnamed Barbarossa, duke of Swabia, was, at the recommendation of his uncle Conrad, chosen as his successor, and the splendor of his reign fully warranted the selection. By the force of his character, Frederick acquired an influence over the diets which had not been possessed by any of his immediate predecessors, and during his reign many important changes were effected in the mutual relations of the great duchies and counties of Germany, while we now for the first time hear of the *hereditary* right possessed by certain princes to exercise the privilege of election. Unfortunately for Germany, this great monarch suffered the interests of his Italian dominions to draw him away from those of his own country, whilst his participation in the crusades, in which both he and the flower of his chivalry perished, was only memorable for the misfortunes which it entailed on the empire. The interval between the death of Frederick Barbarossa (1190) and the accession of Rudolf I. (1273), the first of the Hapsburg line, which, through a female branch, still reigns in Austria, was one of constant struggle, internal dissension, and foreign wars. Individually, the princes of the Hohenstauffen dynasty were popular monarchs, their many noble and chivalrous qualities having endeared them to the people, while one of the race, Frederick II. (1212–1250), was, after Charlemagne, perhaps the most remarkable sovereign of the middle ages; but their ambitious designs on Italy, and their constant but futile attempts to destroy the papal power, were a source of misery to Germany, and with Frederick II. ended the glory of the empire, till it was partially revived by the Austrian house of Hapsburg. His son Conrad IV. (1250–1254), after a brief and troubled reign, was succeeded by various princes, who, in turn, or in some cases contemporaneously, bore the imperial title without exercising its legitimate functions or authority. This season of anarchy was terminated at the accession of Rudolf I. (1273–1291), who, by the destruction of the strongholds of the nobles, and the stringent enforcement of the laws, restored order. His chief efforts were, however, directed to the aggrandizement of his Austrian possessions, which embraced Styria, Carinthia, Carniola, and Tyrol.

For the next 200 years, the history of the German empire presents very few features of interest, and may be briefly passed over. Adolf of Nassau, who was elected to succeed Rudolf, was compelled in 1298 to yield the crown to the son of the latter, Albrecht I. (1298–1308), whose reign is chiefly memorable as the period in which three Swiss cantons, Unterwalden, Schwytz, and Uri, established their independence. After the murder of Albrecht, the throne was occupied in rapid succession by Henry VII. (1308–1313), who added Bohemia to the empire; and conjointly by Frederick of Austria and Ludwig of Bavaria (1313–1349). Charles IV. (1349–1378) of Luxembourg was the successful candidate among many rivals, and although he attended specially to the interests of his hereditary possessions of Bohemia, Moravia, Silesia, and Lusatia, he did not entirely neglect those of the empire, for which he provided by a written compact, known as the *Golden Bull*, which regulated the rights, privileges, and duties of the electors, the mode of the election and coronation of the emperors, the coinage, customs, and commercial treaties of the empire, and the rights and obligations of the free cities. His son, Wenceslaus (1378–1400), who was finally deposed, brought the royal authority into contempt, from which it was scarcely redeemed by Ruprecht of the Palatinate (1400–1410). The nominal reign of Sigismund (1410–1437), the brother of Wenceslaus, would demand no notice were it not for his connection with the councils of Constance and Basel, at the former of which Huss was condemned, and which was followed by the disastrous Hussite wars. The readiness with which Sigismund lent himself to the interests of Henry V. of England, and of all other princes who ministered to his love of personal display, brought discredit on the imperial dignity, while his dishonorable desertion of Huss will ever attach ignominy to his name. Albrecht II. of Austria (1438–1440), after a brief reign of two years, in which he gave evidence of great capacity for governing, was succeeded by his cousin, Frederick III. (1440–1493), an accomplished but avaricious and indolent prince, whose chief object seemed to be the aggrandizement of the House of Austria, with which the title of emperor had now become permanently connected (see AUSTRIA), while he neglected the interests of Germany collectively, and suffered the infidels to make unchecked advances upon its territory. Maximilian I. (1493–1519), the son and successor of Frederick, resembled him in few respects, for he was active, ambitious, and scheming, but deficient in steadiness of purpose. His marriage with Mary, the rich heiress of her father, Charles the Bold, of Burgundy, involved him in the general politics of Europe, while his opposition to the reformed faith preached by Luther exasperated the religious differences which disturbed the close of his reign. Maximilian had, however, the merit of introducing many improvements in regard to the internal organization of the state, by enforcing the better administration of the law, establishing a police and an organized army, and introducing a postal system. With him originated, moreover, the special courts of jurisdiction known as the 'Imperial Chamber' and the 'Aulic Council;' and in his reign, the empire was divided into ten circles, each under its hereditary president and its hereditary prince-convoker. Maximilian lived to see the beginning of the Reformation, and the success that attended Luther's preaching; but the firm establishment in Germany of the reformed faith, and the religious dissensions by which its success was attended, belong principally to the reign of his grandson, Charles I., king of Spain, the son of the Archduke Philip and of Joanna, the heiress of Spain, who succeeded to the empire under the title of Charles

V. (1519–56). The management of his vast possessions in Spain, Italy, and the Netherlans, and the wars with France, in which he was so long implicated, diverted him from his German territories, which he committed to the care of his brother Ferdinand. The princes of Germany were thus left to settle their religious differences among themselves, and to quell, unaided by the head of the state, the formidable insurrection of the peasants (1525), which threatened to undermine the very foundations of society. This rising of the lower orders was due to the preaching of the fanatic Münzer, and other leaders of the sect of Anabaptists, which had arisen from a perverted interpretation of some of the tenets advanced by Luther. Charles's determined opposition to the reformers rendered all settlement of these religious differences impracticable; and although, by the aid of ally, Maurice of Saxony, he broke the confederation of the Protestant princes, known as the Union of Smalkald, he was forced by his former ally to make concessions to the Lutherans, of which he disapproved; and in his disgust at the complicated relations in which he was placed to both parties, he abdicated in favor of his brother Ferdinand (1556–64), who put an end to much of the religious dissension that had hitherto distracted the empire, by granting entire toleration to the Protestants. Although Ferdinand was, personally, mild and pacific, his reign was troubled by domestic and foreign aggressions—the different sects disturbing the peace of the empire at home, while the French and the Turks assailed it from abroad. During the next fifty years the empire was a prey to internal disquiet. Maximilian II. (1564–76) was indeed a wise and just prince, but the little he was able to effect in reconciling the adherents of the different churches, and in raising the character of the imperial rule, was fatally counteracted by the bigotry and vacillation of his son and successor, Rudolf II. (1576–1612), in whose reign Germany was torn by the dissensions of the opposite religious factions, while each in turn called in the aid of foreigners to contribute towards the universal anarchy which culminated in the thirty years' war, begun under Rudolf's brother and successor Matthias (1612–19); continued under Ferdinand II. (1619–37), an able, but cruel and bigoted man; and ended under Ferdinand III. (1637–57), by the treaty of Westphalia, in 1648. The effect of the thirty years' war was to depopulate the rural districts of Germany, destroy its commerce, burden the people with taxes, cripple the already debilitated power of the emperors, and cut up the empire into a multitude of petty states, the rulers of which exercised almost absolute power within their own territories. Leopold I. (1658–1705), a haughty, pedantic man, did not avail himself of the opportunities afforded by peace, for restoring order to the state, but suffered himself to be drawn into the coalition against France, whilst his hereditary states were overrun by the Turks. Although success often attended his arms, peace brought him no signal advantages. The reigns of Joseph I. (1705–11) and Charles VI. (1711–40), with whom expired the male line of the Hapsburg dynasty, were signalized by the great victories won by the imperialist gen., Prince Eugene, in conjunction with Marlborough, over the French; but they brought no solid advantage to the empire. The disturbed condition of Spain and Saxony opened new channels for the interference of Germany, which was further distracted, after the death of Charles, by the dissensions occasioned by the contested succession of his daughter, Maria Theresa, and, through her, of her husband, Francis I. of Lorraine (1745–65), after their rival, the Bavarian elector, Charles VII., had, through the intervention of Prussian aid, been elected in 1742 to the imperial throne, which, however, he was obliged to cede, after a brief occupation of three years. Constant disturbances, intensified during the seven years' war, when Frederick the great, of Prussia, maintained his character of a skillful general at the expense of the Austrians, made the reign of these sovereigns one of trouble and disaster. Joseph II., their son (1765–90), during the lifetime of Maria Theresa, who retained her authority over all the Austrian states, enjoyed little beyond the title of emperor, to which he had succeeded on his father's death. But when he ultimately acquired his mother's vast patrimony, he at once entered upon a course of reforms, which were, however, premature, and unsuited to the cases to which they were applied, whilst his attempts to re-establish the supremacy of the imperial power in the s. of Germany were frustrated by Prussian influence. Leopold II., after a short reign of two years, was succeeded in 1792, by his son, Francis II., who, after a series of defeats by the armies of the French republic, and the adhesion, in 1805, of many of the German princes to the alliance of France, which led to the subsequent formation of the Rhenish confederation under the protectorate of Napoleon, resigned the German crown, and assumed the title of emperor of Austria. From this period till the congress of Vienna in 1814–15, Germany was almost entirely at the mercy of Napoleon, who deposed the established sovereigns, and dismembered their states in favor of his favorites and dependents, while he crippled the trade of the country, and exhausted its resources by the extortion of subsidies or contributions. As a reconstruction of the old empire was no longer possible, those states which still maintained their sovereignty combined, in 1815, to form a German confederation. Of the 300 states into which the empire had once been divided, there now remained only 40, a number which has since been reduced to 35 by the extinction of several petty dynasties. The diet was now reorganized, and appointed to hold its meetings at Frankfurt-on-the-Main, after having been formally recognized by all the allied states as the legislative and executive organ of the confederation; but it failed to satisfy the expectations of the nation, and soon became a mere political tool in the hands of the princes, who simply made its decrees

subservient to their own efforts for the suppression of every progressive movement. The French revolution of 1830 reacted sufficiently on some of the few German states to compel their rulers to grant written constitutions to their subjects; but the effect was transient; and it was not till 1848, that the German nation gave expression, by open insurrectionary movements, to the discontent and the sense of oppression which had long possessed the minds of the people. The princes endeavored, by hasty concessions, to arrest the progress of republican principles, and, fully recognizing the inefficiency of the diet, they gave their sanction to the convocation, by a provisional self-constituted assembly, of a national congress of representatives of the people. Archduke John of Austria was elected vicar of the newly organized national government, but he soon disappointed the hopes of the assembly by his evident attempts to frustrate all energetic action on the side of the parliament, while the speedy success of the anti-republican party in Austria and Prussia damped the hopes of the progressionists. The refusal of the king of Prussia to accept the imperial crown which the parliament offered him was followed by the election of a provisional regency of the empire, but as nearly half the members had declined taking part in these proceedings, or in a previous measure, by which Austria had been excluded, by a single vote, from the German confederation, the assembly soon lapsed into a state of anarchy and impotence, which terminated in its dissolution. The sanguinary manner in which insurrectionary movements had, in the meanwhile, been suppressed by Prussian troops both in Prussia and Saxony, put an effectual end to republican demonstrations; and in 1850, Austria and Prussia, after exhibiting mutual jealousy and ill-will, which more than once seemed likely to end in war, combined to restore the diet, whose first acts were the intervention in Slesvig-Holstein in favor of Denmark, and the abolition of the free constitutions of several of the lesser states. Since that period, the diet has been the arena on which Austria and Prussia have striven to secure the supremacy and championship of Germany, and every measure of public interest has been made subservient to the views of one or other of these rival powers. These states did, however, conclude a treaty of alliance in 1854, guaranteeing to each other the mutual defense of their possessions against all enemies—a compact in which the diet soon joined. In 1858, a currency convention was concluded between all the states of the German confederation, which had previously entered into similar alliances for the adjustment of international postal and commercial relations; and in the same year the diet adopted a resolution by which the Danish government was called upon to submit to the legislative assemblies a new project for the political organization of the duchies of Holstein, Lauenburg, and Slesvig. In 1859, after many stormy discussions, the assembly passed a resolution to mobilize the whole federal army, and to appoint the Prussian prince regent commander-in-chief, subject to the control of the diet, or virtually of Austria, with which rested the casting-vote in the federal assembly. This appointment did not satisfy the views of Prussia, which, however, abstained, for a time, from making any direct attempt to secure the political leadership in Germany. The anti-Napoleonic feeling, which at a later period swelled to such a tide, manifested itself decidedly during the difficulties between France and Austria in 1859; and the discussions and apprehensions to which this sentiment gave rise, together with the consideration of the Slesvig-Holstein difficulties, constituted the principal questions under discussion in the federal parliament, down to the rupture between Prussia and Austria, and the dissolution of the bund in 1866. For the later history of Germany, see GERMANY and BISMARCK in SUPP., Vol. X., also FRANCE.—*Scriptores Rerum German. apud Menkenium;* Mannert, *Gesch. d. Teutschen;* Sismondi, *Histoire des Français;* Putter, *History of the German Constitution;* Raumer, *Hist. of the Hohenstauffen;* Coxe, *House of Austria;* Eichhorn's *Deutsch. Staats-Rechtsgesch.;* Carlyle. *Hist. of Fred. II.;* Schulze, *Einleitung in das Deutsche Staatsrecht*, etc. (Leip. 1867); Meyer, *Grundzüge des Norddeutschen Bundesrecht* (Leip. 1868); Hirth. *Annalen des Nordd. Bundes*, etc. (Berl. 1868); and *Annalen des Deut. Reichs* (1871); Auerbach, *Das neue Deut. Reich und seine Verfassung* (Berl. 1871); and Hausen, *Die Verfassung des Deut. Reichs* (Nordl. 1871).

German Language and Literature.—The numerous dialects which were spoken by the different confederacies and tribes of ancient Germany were all derivatives from one branch of the Aryan or Indo-Germanic family of languages, which separated from the parent stock at a very early period, although subsequently to the separation of the Celtic. We can trace the co existence of the two branches of Teutonic speech known as low-German and high-German as far back as the 7th c., but there is no evidence to show that they existed as common uniform languages, from which their variously modified dialects were respectively derived. According to the eminent philologist, Max Müller, there never was *one* common Teutonic language which diverged into two streams; while the utmost we can venture to assert in regard to the various high and low-German dialects is, that they respectively passed, at different times, through the same stages of grammatical development. The high-German branch—which was spoken in the dialects of Swabia, Bavaria, and Austria, and parts of Franconia and Saxony—has been the literary language of Germany since the days of Charlemagne. It may be classified under three periods—the old high-German, dating from the 7th c. and extending to the period of the Crusades, or the 12th c.; the middle high-German, beginning in the 12th c., and continuing till the reformation; and the new high-German, dating from

Luther's time to our own days. The low-German, which in Germany itself has been little used in literature, comprehends many dialects, as the Frisian (q.v.), the Flemish, Dutch, Platt-Deutsch, etc. The oldest literary monument of low-German belongs to the 9th c., and is a Christian epic known as *the Heliand* (the Healer or Savior); and although there are traces of popular low-German literature up to the 17th c., the translation of the Bible into high-German by Luther decided the fate of low-German. In addition to the various dialects which are commonly included under the heads of high and low-German, an important evidence of the cultivation of a form of German, differing equally from the high and low groups, has been preserved to us. This important linguistic monument is a fragment of a Gothic translation of the Bible, which was made in the 4th c. by bishop Ulfilas, and used by all the Gothic tribes when they advanced into Italy and Spain. The Gothic language died out in the 9th c.; and after the extinction of the power of the Goths, the translation of Ulfilas was forgotten and lost sight of till the accidental discovery, in the 16th c., of a MS. preserved in the abbey of Werden, and containing fragments of this important work. This MS. is a copy made in the 5th c. of Ulfilas's translation, and, fragmentary as it is, it affords evidence of the high degree of development to which this dialect had been carried, and exhibits a form of speech which belongs to neither the high nor low-German group, but very possibly may have been merely one among numerous other allied forms of Teutonic speech which have perished.

The diffusion of Christianity among the Germanic tribes had the effect both of suppressing the use of the Runic characters that had been common to them, and of changing the character of their literature, for instead of the heroic songs and "beast-epics" of a sanguinary paganism (*Their-epos*), scriptural paraphrases, legends, and hymns were now selected; while the ancient form of alliteration by degrees gave place to the rhythmical arrangement of the Latin versification common in the early periods of the middle ages. Latin, moreover, became the language of the court, the church, and the law, under the Saxon emporers, while German was left entirely to the people, until the new ideas, which were diffused both in regard to literature and language during the Crusades under the rule of the accomplished emperors of the Hohenstauffen line, had the effect of reviving the use and cultivation of the vernacular dialects, among which the Swabian, as the language of the court, soon acquired a marked preponderance over the others. In that age of chivalry and romance, the art of song was cherished by princes and nobles, many of whom belonged to the order of the *Minnesänger* (or singers of love), and composed in the Swabian or high-German dialect of the imperial court. The subjects chiefly selected during the 13th and 14th centuries, both by courtly and popular singers, were based on the legendary lore of Charlemagne and his paladins, and king Arthur and his knights, and of the Sangrael; and it is to this period that we must refer the *Nibelungen Lied* and *Gudrun*, which rank as the greatest treasures of German national literature. Among the most successful poets and minne-singers belonging to the Swabian period, we may specially indicate Heinrich von Veldeke, Hartmann von der Aue, Wolfram von Eschenbach, Walther von der Vogelweide, Neidhart of Bavaria, Heinrich von Ofterdingen, etc. The taste for the *Their-epos* received a new impetus among the people in the middle of the 12th c. by the re-translation, from the Walloon into German, of the ancient poem of *Reinhard Fuchs*, which, according to the distinguished philologist Jakob Grimm, originated with the Frankish tribes, who carried it with them when they crossed the Rhine and founded an empire in Gaul, and from whom it was diffused among the neighboring tribes of Northern France and Flanders.

The period which succeeded the decline of chivalry was marked by a thorough neglect, among the higher classes, of national literature, which thus fell into the hands of the people, to the thorough disorganization of all principles of grammar. To this age belongs, however, the great mass of the *Volkslieder*, or national ballads, in which Germany is specially rich; the fables and satires of Brand and of Sachs, and the romances of the satirist Johann Fischart. The mysteries and passion-plays, which were at their height in the 15th c., and still linger in the village of Oberammergau, in Upper Bavaria, may be said to have given origin to the German drama, which numbered among its earliest cultivators, Sachs, Rebhuhn, and Ayrer. The close of the 15th c. was prolific in rhyming historical chronicles, in satires on the clergy, and in theological writings for and against the tottering power of the Romish church. The writings of Luther, his translation of the Bible, and the works of Ulrich von Hutten, Zuinglius, and of many of the other reformers, were, however, the most important events in the history of German literature from the close of the 15th to the middle of the 16th c.; and it must be remembered that Luther addressed himself to the minds of his countrymen not merely through his polemical writings, but also by those noble hymns, which, since his day, have constituted one of the greatest literary treasures of the kind. Some of the best of these *Kirch-lieder*, or church songs, were composed by Luther himself; while next to him those of Speratus, Decius, Nicolai, and Herberger have, perhaps, found most favor both among Germans and foreigners. These fervent effusions of the devout and eloquent reformers were followed by a period of literary degeneration and stagnation, which is in a great measure to be ascribed to the demoralizing effects of the thirty years' war, when Germany was a prey to all the evils inseparable from civil war fostered by foreign interference. The indirect result of this period of anarchy was to quench the national

spirit, and vitiate the popular taste; for, while the petty courts aped the habits, language, and literature of Versailles, the lower orders forgot their own literature, with its rich treasures of legends, tales, and ballads, and acquired a taste for the coarse camp-songs, imported by foreign mercenaries and the immoral romances borrowed from impure French and Italian sources. German poetry in the 17th c. was framed after the model of the later classics, and their modern imitators. The study of the genuine national literature was neglected, and although a host of learned societies were formed, whose professed object was to purify and elevate the public taste, the results were lamentably unsatisfactory; and it was not till J. C. Gottsched (1700–66) succeeded in his *Critical Art of Poetry* in drawing attention to the turgid pedantry and artificial stiffness of the classicist school, that a better taste was awakened. His own pretentious bigotry gave origin, however, to a counter-party, from which emanated, at a somewhat later period, the German æsthetic school, under the guidance of A. Baumgarten and G. Meier. A favorable reaction now took place, and with the names of Klopstock, Lessing, and Wieland began the brilliant epoch of modern German literature. Their influence was alike great and varied; for while Klopstock's poem of the *Messiah*, and his odes, in which he had taken Milton as his model, re-echoed the tender piety of the old reformers, and were so thoroughly German in their spirit, that they at once met with an enthusiastic response in the hearts of the people, Lessing's tragedy of *Minna v. Barnhelm*, and his drama of *Nathan der Weise*, may be said to have created anew the dramatic art in Germany. Wieland, on the other hand, who was the complete antithesis of Klopstock, although, like his two great contemporaries, he was the founder of a new style, and gave a graceful flexibility to German diction, which it had never before been made to assume, had imparted to his numerous tales and romances an undisguised sensuous materialism, which, like his style, had been borrowed from the French philosophers of his day, and thus introduced into the language and literature of Germany the germs of many defects, as well as graces, to which they had hitherto remained strangers. The influence exerted on German literature by these three writers, who may be regarded as its regenerators, was soon appreciable in every branch of knowledge; and among the galaxy of great names which have imparted renown to the literary and scientific annals of Germany during the last 100 years, we can only instance a few of the principal writers who have more especially enriched the several departments of learning with which they have been associated.

Philosophy, which in Germany originated with Leibnitz, who, however, wrote in Latin and French, assumed a degree of individuality and completeness through the intellectual acumen and subtle analysis of Kant, Fichte, Schelling, and Hegel, which have no parallel in any other country. Other names worthy of mention in this department are Herbart, Schopenhauer, and Baader. In theology, Reinhard, Paulus, Schleiermacher, Neander, Julius Müller, Lücke, Baur, Strauss, Mühler, Döllinger, and a host of others, have infused new life into biblical inquiry; while invaluable aid has been afforded in the same direction by the profound philological and critical researches of Wolf, Hermann, Müller, the erudite brothers J. and W. Grimm, Bopp, Benecke, Adelung, Lassen, Rosen, Schlegel, W. Humboldt, Lepsius, Bunsen, etc. In archæology, history, and jurisprudence, all nations owe a debt of gratitude to Winckelmann, Heeren, Von Raumer, Schlosser, Von Hammer, Gervinus, Dahlmann, Ranke, Niebuhr, and Mommsen. In poetry and belles-lettres, the name of Goethe (who lived from 1749 to 1832) is a host in itself. He had been preceded in the school to which he attached himself, which was known as that of the *Sturm-und-Drang* period, by Herder, its originator, whose philosophical critiques of foreign and German literature contributed materially to the complete literary revolution which ushered in the modern period of German poetry. In his *Leiden des Jungen Werther* (The Sorrows of Werther), Goethe carried the sentimental tendencies of the school to their culminating point; but his own later and very numerous works became in time more and more free from the blemishes into which he had led others. The *Sturm-und-Drang* period closed with Schiller (1759-1805), whose early works, *The Robbers*, *Fiesco*, and *Don Carlos*, threw the whole German people into a frenzy of excitement. His later dramatic works, if less exciting than these, gave evidence of more matured taste, while some of his ballads and lyrics may be said to be unrivaled. In the present century, poetry has found noble representatives in the so-called *Vaterlandsdichter* (Poets of the Fatherland), among whom we may instance Theodor Körner, and Arndt, whose spirited patriotic songs are intimately associated with the war of 1813 against Napoleon, in which the former fell fighting gloriously. F. Rückert and L. Uhland belong to the same school; but the former is more especially known for his admirable adaptations and translations from the oriental languages, and the latter for his exquisite romances and ballads. A still greater name is that of Heine, who may rank almost with Goethe and Schiller in poetic power. We may also mention the names of Müller, Hoffmann von Fallersleben, Platen, Freiligrath, Geibel, who, amidst a crowd of others, are highly esteemed in their native country. The influence of Goethe and Schiller extended in a marked degree to the drama and to novel-writing. In the former department, Iffland acquired great reputation as a writer of sensation dramas, A. von Kotzebue as an inexhaustible composer of light effective comedies, A. Müllner von Honwald, F. Grillparzer, and E. Raupach for their historical and social tragedies, while C. Immermann (who is better known as the author of the novel *Münch-*

hausen), Mosen, Laube, and C. Freytag, have all produced good dramatic pieces. Among the host of novelists who have endeavored to follow in the steps of the great leaders of the *Sturm-und-Drang* period, the majority do not require notice. J. P. Richter, the satirist and humorist, stands forth, however, apart from and far above his compeers; and few novelists ever exerted so lasting an influence on the literature and mode of feeling of their compatriots as that which Richter exercised over the minds of the middle classes of Germany, during the close of the last and the early part of the present century. Among other writers of note, we may instance De la Motte Fouqué, A. Hoffmann, and A. Chamisso, whose tendencies were to dwell on the mysterious agencies of nature, which they attempted to individualize, and bring into association with material forms, as in the *Undine* of the first, the fantastic tales of the second, and the *Peter Schlemihl* of the last-named. C. Pichler, Spindler, H. Steffens, C. Gutzkow, Sternberg, W. Häring (the imitator of Sir W. Scott), Hauff, Zschokke, an admirable writer of *novelettes*, Hackländer, Ida von Hahn-Hahn, Auerbach, Freytag, Gerstäcker, Gottschall, Spielhagen, and Paul Heyse have all in turn enjoyed wide popularity, and some of them not as novelists only.

But numerous as have been writers of poetic and dramatic literature during the present century in Germany, the tendency of the German mind has of late years been rather to science than fiction; and the immense impetus given to the taste for scientific inquiry by A. von Humboldt's travels and observations, and by his *Cosmos* and *Views of Nature*, has been followed by the prosecution of the most profound researches in every department of physical and natural science, and by the appearance of a multitude of records of travel, among the more important of which we can only instance a few, as, for example, those of Martius in Brazil, Pöppig in S. America, Tschudi in Peru, Schubert in Greece, Lepsius and Brugsch in Egypt, Schomburgk in British Guiana, Gützlaff in China, Siebold in Japan, the three brothers Schlagentweit in the Alps and in Central Asia, Barth and Vogel in Africa, and Leichhardt in Australia. In conclusion, we can only group together the names of a few of the many eminent Germans who by their labors have at once enriched the science of the world, and enhanced the literary and scientific glory of their own country. Without again referring to writers whom we may have already mentioned, we may specially instance, in astronomy and mathematics, Bessel, Encke, Struve, Gauss and Mädler; in the natural sciences, and in medicine, J. Müller, Ehrenberg, Carus, Oken, Schleiden, Von Buch, Liebig, Kopp, Simon Dove, Valentin Moleschott, Bischoff, Rose, Poggendorf, Erdmann, Gmelin, Gräfe, Vogel, Rokitansky, Wagner, Schönbein, Helmholtz, and Dieffenbach; in history and biography, Niebuhr, Leo, Duncker, Preuss, Böttiger, Varnhagen von Ense, Pertz, Lappenberg, Pauli, etc.; in geography, ethnology, statistics, and travels, Berghaus, Petermann, Stein, Hübner, Klöden, Kohl, Reinbeck, Bunsen, Ideler, Lassen, Unger, Zimmermann; in the history of language, literature, and the fine arts, and on politics and the social sciences, Vilmar, Bouterwek, Kuno Fischer, Waagen, Heinsius, Heyse, Becker, Creuzer, Lersch, Wachler, Ernesti, Jacobs, Savigny, Eichhorn, Bülow, Ersch. See Grimm, *Geschichte d. Deutschen Sprache*, and *Deutsche Grammatik*; Bopp, *Comparative Grammar*; Bessel, *Ueber das Leben des Ulfila*; M. Müller, *On the Science of Language*; Koberstein, *Grundriss der Deutschen Nationalliteratur*; the works of Wackernagel, Vilmar, Kurz, and Cholevius; and in English, Hallam's *Europe in the Middle Ages.*

GERMANY. [From Supplement.] The important changes which have taken place within recent years in the political relations of the component parts of Germany having been but slightly touched upon in the article GERMANY in the body of this work, we purpose here to give some account of these changes, and of the wars which led to them. The immediate occasion of the war of 1866 was the difference that arose between Prussia and Austria as to the occupation and disposal of the territory taken from Denmark (see SLESVIG) after the convention of Gastein (1865). But the real grounds lay in that rivalry between the two states for the leadership of Germany, the germ of which is as old as the time of the great elector (see FREDERICK-WILLIAM), and which has shown itself at many epochs of the history (see GERMANY, *History*). There can be little doubt that the feeling of the German people, as distinguished from the princes and bureaucracy, has, in recent times at least, been in favor of the purely German Prussia as their leader, rather than Austria, the great mass of whose population are Slaves and Magyars. And when the parliament of Frankfurt, in 1850, offered the imperial crown to the king of Prussia, the unity of Germany might have been secured without bloodshed, had the monarch been resolute, or had he had a Bismarck for his adviser. But that opportunity being let slip, and the incubus of the "bund" being restored, it became apparent that the knot must be cut by the sword.

By the treaty of Gastien, Austria and Prussia agreed to a joint occupation of the Elbe duchies; but to prevent collision, it was judged prudent that Austria should occupy Holstein, and Prussia, Slesvig. Already a difference of policy had begun to show itself: Prussia was believed to have the intention of annexing the duchies; while Austria began to favor the claims of prince Frederick of Augustenburg, and wished to refer the disposal of the matter to the bund. In the meantime, both nations were making ready for the struggle. In fact, the preparations of Prussia had been going on for two or three years; and the new organization of her army, which had occasioned the protracted con-

test between the government and the house of deputies, had been made with a view to some such eventuality as was now to occur. The preparations of Austria were made more openly, as she could plead the necessity of meeting the warlike attitude of Italy; which power, looking upon the quarrel between Austria and Prussia as a precious opportunity, was actively arming, with a view to strike a blow for the liberation of Venetia, and had secretly entered into an alliance with Prussia.

At this crisis, England, France, and Russia invited the disputants to a conference. Prussia and Italy readily consented; but nothing came of it, through the obstinate pride of Austria, who would not allow her position in Italy to be even taken into consideration. Never, perhaps, was a greater blunder made. Had she at this moment ceded Venetia for a reasonable compensation, she would have replenished her empty treasury with a good many millions, have made Italy friendly, or at least neutral, and set free her best army of 80,000 veterans for the inevitable contest with her northern rival. A few weeks later, she made the concession with a bad grace, without compensation, and to no purpose.

On the failure of the conference, Benedek, commander-in-chief of the Austrian army of the north, issued an order of the day, dated 12th May, in which he announced that he had been appointed "to lead the brave and faithful Austrian army against the unjust and wanton foes of the empire." It only remained to find a formal ground for the declaration of war, and that ground was found in the Slesvig-Holstein question. In the sitting of the German diet, June 1, 1866, Austria, disregarding the convention of Gastein, placed the whole matter at the disposal of the bund, and then proceeded to convoke the states of Holstein "to assist in the settlement of the future destination of the duchy." Prussia protested against this as an insult and a violation of treaty; demanded the re-establishment of the joint occupation; and, while inviting Austria to send troops into Slesvig, marched troops of her own into Holstein. Instead of responding to this invitation, Austria withdrew her forces altogether from Holstein, under protest; and then, calling attention to this "act of violence" on the part of Prussia, proposed that the diet should decree "federal execution" against the enemy of the empire. This eventful resolution was carried by a great majority on June 14, 1866; Hanover, Saxony, Hesse-Cassel, Hesse-Darmstadt, and the 16th Curie voting for it. The resolution having passed, the Prussian plenipotentiary, in the name of his government, declared the German confederation dissolved for ever, and immediately withdrew.

When the news of the federal execution was received in Berlin, identical notes were sent to the courts of Saxony, Hanover, and Hesse-Cassel, demanding the reduction of their armies and assent to the convocation of a common German parliament; on which condition, Prussia would guarantee their territories and sovereign rights as her allies. Twenty-four hours were allowed for the decision; and when the term had expired without assent, the Prussian troops, which had previously been concentrated on the frontiers, crossed at once into the three kingdoms, and took military possession without resistance. The Saxon army retired into Bohemia, to join the Austrians; that of Hanover, after vainly trying to make its way s. to join the army of the bund, and bringing on the useless affair of Langensalza, was forced to lay down its arms and return home.

Besides the moral advantage gained by this display of promptitude, in paralyzing her declared enemies and securing the adhesion of waverers, Prussia had by these occupations secured her rear, and, in Saxony, had won a favorable basis for operating against Austria. The Prussians now lost no time; war was declared against Austria; and following the example set by Frederick the Great, the troops immediately began to march into Bohemia. To their own surprise, as well as that of all Europe, they were allowed to pass the easily-defended defiles without opposition, or even seeing an enemy. So great was the reputation of Benedek, that every one now began to look for some deep-laid plan by which the enemy was to be enticed into the heart of the country, only to be completely and at once overwhelmed. But, as it turned out, there was no plan at all. With their usual sluggishness, the Austrians were taken by surprise in a state of unreadiness—ill organized, ill equipped, ill provisioned; and although in actual engagement the soldiers fought bravely, they were animated with a very different spirit from their opponents. The Prussian people had at the outset been rather averse than otherwise to the war; and in some places, it required strong measures to make the landwehr take the field. But once under arms, and as the object of the struggle became more apparent, they entered into it with enthusiasm, and manifested a rare combination of soldierly qualities, the results of a universally diffused education and military training, and while such was the quality of the men, seldom has an army taken the field so well organized, with the plan of the campaign so well laid, the arms so efficient, and the equipments in every way so complete.

The Prussian host invaded Bohemia at three several points: the central army, under prince Frederick-Charles (q.v.), entered from eastern Saxony, crossing the frontier range of the Erzgebirge by Krottau, Friedland, and Neustadt, towards Reichenberg; the western or "Elbe" army, under gen. Herwarth von Bittenfeld, started from Dresden, and entered Bohemia by Neustadt and Schlukenau towards Gabel; while the eastern or "Silesian" army, under the crown-prince, Frederick-William (q.v. in SUPP., vol. X.) invaded from Silesia by the Landshut and Nachod passes, marching towards Trautenau and Skalitz. The first of these armies numbered 72,000 infantry, 11,000 cavalry, and

294 guns; the second, 34,000 infantry, 3,900 cavalry, and 132 guns; and the third, 92,000 infantry, 12,500 cavalry, and 348 guns—in all, 225,400 men and 774 guns. To oppose these, the Austrians had 55,000 infantry, 5,400 cavalry, and 172 guns (inclusive of the Saxon army, which had been withdrawn into Bohemia on the approach of the Prussians), under count Clam-Gallas, stationed along the frontier n. of Turnau and Leitmeritz; and 186,000 infantry, 16,000 cavalry, and 544 guns, under marshal Benedek, the commander-in-chief, in eastern Bohemia, behind the Riesengebirge—in all, 262,400 men, and 716 guns. As the Austrians expected the attack from Silesia, by far the greater portion of their army was stationed behind the Riesengebirge; so that when Von Bittenfeld and prince Friedrich Karl crossed the Erzgebirge (June 24), they found themselves opposed by only the outlying brigades of Clam-Gallas, which they forced to retire towards Turnau and Münchengrätz, after defeating them in some insignificant combats at Reichenberg, Langenbrück, Liebenau, and Turnau, and in a severe struggle at Podol, which cost the Austrians in all 2,400 in killed, wounded, and prisoners; the loss of the Prussians being only 124 men. The first and second Prussian armies, now united, advanced leisurely, driving the enemy before them towards Münchengrätz, where Clam-Gallas had strongly posted himself, and where, on June 28, he was attacked by the combined Prussian armies, and after a brief but severe contest, forced to retreat in haste. By several routes, the combined armies under prince Friedrich-Karl now continued their onward march, routing the detached corps of Austrians and Saxons which attempted to bar their progress; and after a severe contest (June 29), which cost the Prussians 2,000 men, and the Austrians about twice as many, took possession of Gitschin, and encamped on the following morning between that town and Horzitz, having established communications with the crown-prince; while Clam-Gallas retired to join the main body under Benedek, after having, with a force only half as numerous as his opponents', and still more inferior in guns, compelled his antagonists to spend six days in making an advance of 40 English miles.

Meanwhile, the third Prussian army had advanced in two divisions, the right wing through the passes of the Riesengebirge, by Landshut, towards Trautenau; the left by Glatz, towards Nachod and Skalitz; while the center divisions crossed by Braunau, all crossing the frontier on June 26. The defiles were traversed without opposition, the Austrians being only posted at the mouths of the passes; but, as the left wing under Steinmetz debouched towards Nachod, it was assailed (June 27) by Ramming's Austrian corps, and driven back into the pass. Steinmetz, however, persevered; and by the aid of his guns, and repeated charges of cavalry, succeeded, after a conflict of six hours, in extricating his corps from the defile, at a cost of 1191 killed and wounded, to 6,000 on the part of the Austrians. Both armies being reinforced, the contest was renewed at Skalitz on the 28th; but, though long and bloody, it was on all sides favorable to Steinmetz, who beat the Austrians back upon Josephstadt, with a loss in killed and wounded of 5,815, and 5,850 prisoners, with five guns. The Prussian right wing, under Bonin, had also a double conflict with the Austrians, who were posted to receive them; for, after extricating themselves from the Landshut defile, and seizing Trautenau, they were met (June 27) by general Gablentz, and, after a long-continued fight, were driven back to their previous camping-ground, losing, however, only 1423 men, to about 3,500 of the Austrians. Gablentz being much exhausted with his hardly-won victory, obtained reinforcements from Benedek; and the Prince of Würtemberg, with a corps of guards, being sent by the crown-prince (who marched with the center, ready to afford support to either wing when necessary) to attack Gablentz by Eypel, fell upon him (June 28) while he was preparing to complete the defeate of Bonin, and, after a severe combat, or rather, series of partial unconnected combats, the Austrians were this time defeated, with a loss of 4,000 men and an equal number of prisoners; the Prussian loss being only 834 killed and wounded. The three Prussian armies having thus effected a firm lodgment in Bohemia, moved steadily forward in lines converging to a point n. of the Austrian army, which was now concentrated between Josephstadt and Königgrätz; and the king of Prussia, who had arrived (July 1) at the head-quarters of the 1st and 2d armies, hearing of Benedek's intention to assault them before the crown-prince's army could come to their aid, resolved to anticipate him, and ordered an attack on the Austrian position at 8 A.M. on July 3, at the same time sending off an urgent dispatch to hasten the arrival of the crown-prince, whose host, at 8 A.M. on the 3d, was 15 m. off. The Prussians, at the commencement of the fight, believed they had to do with only the half of the Austrian army, but they were soon undeceived, for, after carrying the villages in front of the Austrian position, and advancing up the slope, they were met by such a crushing fire of artillery as completely stopped their further progress. Benedek then directed his reserves against the Prussian left, in order to cut it off from the crown-prince, but all his endeavors to drive it permanently from its position failed. The conflict, which was mainly an artillery-fight, thus continued without intermission, and the Prussian left was almost on the point of giving way before the overwhelming numbers of its assailants, when the wavering of the Austrian right unmistakably showed that a portion at least of the third army had arrived, and attacked them in flank. This new assailant becoming more formidable every minute, speedily rolled up the Austrian right wing; and the advance of the 1st and 2d armies, by partially enclosing the Austrians between two fires, threw them into great confusion. Their array was soon broken

and dissolved in precipitate flight; multitudes perished in the morasses, in the waters of the Elbe, and under the wheels of the fleeing baggage-wagons; but the undaunted attitude of the splendid Austrian cavalry, and the deficiency of the Prussians in that arm, greatly mitigated the horrors of the rout. The Prussians lost upwards of 9,000 killed and wounded; the Austrian loss was 16,235 killed and wounded, and 22,684 prisoners. After this decisive defeat, which is known as the battle of Königgrätz, or Sadowa, all hope of staying the advance of the Prussians with the army of Benedek was at an end; a truce was asked for, but refused; and the victorious Prussians pushed forward towards Vienna, whither Benedek had drawn his beaten forces. At the same time, the southern army, which had been employed against the Italians, was collected at the capital, and every precaution was taken, by the erection of entrenchments, fortifications, etc., to insure the safety of Vienna, when, by the agency of the emperor of the French, a truce was agreed to, which afterwards led to a treaty of peace.

A few days before this campaign had commenced, the Italians, burning with eagerness to free Venetia from the yoke of the alien, and combining, with all the enthusiasm and heroic spirit of a young nation, no small portion of its overweening presumption, had assembled an army of 200,000 men, one half of which, gen. Della Marmora, was destined to cross the Mincio between Peschiera and Mantua, while the other half was stationed round Bologna to operate on the lower Po. To oppose this force, the archduke Albert, the commander-in-chief in Venetia, had about 90,000 men near Verona, besides the garrisons of the Quadrilateral and Venice, which, of course, were not available for field-service. On June 23 (on which day it was notified to the archduke that hostilities would be commenced), La Marmora's army crossed the Mincio, unopposed by the Austrians; and the Italian commander, not expecting attack, masked the fortresses of Peschiera and Mantua, and marched the rest of his army forward in a somewhat careless fashion. The archduke, however, had been all along watching his opponent; and after having succeeded in getting him entangled between the river and the hills, he attacked him (June 24) with his whole force. The Italian left was speedily broken and driven back, and would have been wholly destroyed had not gen. Pianell, whose division was on the right bank of the Mincio, crossed the river, and held the assailants at bay during the rest of the day. The Austrian attack on the Italian right was, however, at first unsuccessful. In the center, where were situated the village of Custoza and Monte Belvedere, the keys of the position, an obstinate struggle was maintained on both sides throughout the day, but towards 4 p. m. victory inclined to the Austrians, and soon after they gained possession of the position which decided the day. The Italians fell back, in fair order, towards the Mincio, unpursued by their exhausted opponents, and on the following day, were all again assembled on the right bank of the river. The Italians lost in killed, wounded, and prisoners, 8,175 men, and several pieces of artilery; while the loss of the Austrians was about 8,000 men. This plan of the campaign having failed, the Italian generals set about devising another, and spent more than a week in deliberation and discussion. At the end of this time, news came of the great defeat which the Austrians had sustained in the north, and of the cession of Venetia, by the emperor of Austria, to the emperor Napoleon. Though it was not for a moment in doubt that this cession was only a round-about way of surrendering the province to Italy, the Italian government, true to the Prussian alliance, refused to conclude a separate treaty; and (the archduke's army having been, as before mentioned, withdrawn for the defense of Vienna) Cialdini's army crossed the Po (July 7), and occupied Padua, Vicenza, and Treviso; while Garibaldi, at the head of his volunteers, and gen. Medici, with a division of Cialdini's army, advanced up the lake of Garda into the Trentino, the small body of Austrians in the district being wholly unable to offer a successful resistance to such an overwhelming attack. Not content, however, with attacking Austria by land, a fleet was equipped, and dispatched, under admiral Persano, to assail the Dalmatian coast, and retrieve for Italy, by her navy, the disgrace which had fallen upon her army; and, accordingly, Persano directed an attack on the island and forts of Lissa, and failed. News of this attack being communicated to admiral Tegethoff, the commander of the Austrian fleet in the Adriatic, he sailed at once for the relief of Lissa; and though his ships were inferior in number, size, and weight of ordnance, and only 7 of them ironclads, to 12 more powerful vessels of the same sort in the Italian fleet, he bravely led his ships to the attack, destroyed or sunk two of the largest of the enemy's vessels, broke through his fleet, and took up a position in front of Lissa, ready to renew the fight if necessary. The Italian fleet, however, drew off, and on the following morning, was out of sight, making for Ancona.

Thus baffled both on land and sea, Italy, though vigorously professing her determination to go hand in hand with Prussia, was very loath to agree to the armistice sighed by the two belligerent German powers at Nikolsburg, on July 26; and attempted to salve her chagrin by insisting upon the surrender by Austria to her of the Trentino. Prussia, however, having agreed with Italy only for the cession of Venetia, was not inclined to support this demand; and Italy seeing that she must either make peace or fight for the Trentino, single-handed, against Austria, gave way reluctantly, and agreed to the armistice, Aug. 12.

A third contest was, about the same time, in progress between Prussia and those minor states of Germany which had raised armies to support Austria, viz., Bavaria,

Würtemberg, Baden, and Hesse-Darmstadt. After the capture of the Hanoverian army, the Bavarians, who, under prince Charles of Bavaria, had been advancing slowly to join them, took post, on June 30, at Suhl, in the valley of the Werra. A second army had been assembled under prince Alexander of Hesse-Darmstadt, and had been drawn together in front of Frankfort. To prevent the junction of these two armies, the Prussian gen. Vogel von Falkenstein, who had 48,000 infantry, 3,300 cavalry, and 96 guns, threw a part of his forces toward Fulda, and with the remainder attacked the Bavarians, who were inferior in number, and routed them at Dermbach, Kaltenordheim, and Hünfeld, driving them towards Kissingen; he then turned his superior force against prince Alexander, whom he forced to retreat towards Darmstadt. The two armies were now completely separated, and Von Falkenstein found little difficulty in keeping them apart during the rest of the brief campaign, and in routing the Bavarians at Kissingen and Hammelberg, and the Darmstadters at Aschaffenburg, and driving the broken remnants of the two armies s. of the Main. He then crossed the Main, and occupied Würzburg, in Bavaria. After some little delay, peace was concluded between these four minor states and Prussia; but, unlike Austria, of which they were merely the allies, some of them were forced to submit to a certain loss of territory.

The states n. of the Main which had taken up arms against Prussia, were completely incorporated—viz., Hanover, Hesse-Cassel, Nassau, Frankfurt, and a small portion of Hesse-Darmstadt, as well a Slsesvig-Holstein and Lauenberg; and the other states n. of the Main were united with Prussia in a confederacy of a more intimate nature than before existed, called the *North German Confederation*.

Bavaria, Baden, Würtemberg, the part of Hesse-Darmstadt s. of the Main, and Liechtenstein were not included in this union, but were invited to reform their armies and enter into a closer mutual relationship, with a view to a military and political connection with the confederation.

Saxony, which had prominently figured in the contest as an ally of Austria, was doomed by count Bismarck to incorporation; but Austria, supported by France, so steadily opposed this arrangement, that it was abandoned, and the little kingdom was admitted into the confederation.

Austria, by the treaty of Prague (Aug. 23, 1866), was completely excluded from participation in the new organization of the German states, and formally agreed to the surrender of Venetia to Italy, to the incorporation of Slesvig-Holstein with Prussia, and to the new arrangements made by Prussia in Germany. A portion of the fifth article of this treaty secured that, if the "inhabitants of the northern districts of Slesvig declare, by a free vote, their desire to be united to Denmark, they shall be restored accordingly." Though losing no territory to Prussia, Austria had to pay 40 millions of thalers for the expense of the war, after which payment, the Prussian troops were to be withdrawn from the imperial territories.

Saxony resigned to Prussia the right of garrisoning Königstein, and of partially garrisoning Dresden, and paid 10 million thalers of war-indemnity; Bavaria (by treaty of Berlin, Aug. 22) surrendered several districts of lower Franconia to Prussia, and paid 30 millions of gulden for war-indemnity; Baden (by treaty of Berlin, Aug. 17) and Würtemberg (by treaty of Aug. 13) surrendered no territory, but paid, the former 6 and the latter 8 millions of gulden; while Hesse-Darmstadt (by treaty of Berlin, Sept. 3) surrendered various districts of the province of Ober-Hesse, receiving in return several districts formerly belonging to Electoral Hesse, Nassau and Frankfurt, and paid 3 millions of gulden for war expenses; also the province of Ober-Hesse, into which were to be incorporated the districts ceded by Prussia, was to form a part of the North German confederation, the other parts of the grand duchy s. of the Main being unconnected with it. Even the little principality of Reuss had to pay 100,000 thalers into the fund for Prussian invalids.

The North German confederation, as thus constituted, possessed a common parliament, elected by universal suffrage, in which each state was represented according to its population. The first, or constituent, parliament met early in 1867, and was employed in deliberating over the details of the proposed constitution for the bund, which was drawn up and submitted to it by count Bismarck After some weeks' discussion, the draft, with a few modifications, was agreed to; the new elections then took place, and the first regular North German parliament met in Sept., 1867. According to this constitution, there was to be a common army and fleet, under the sole command of Prussia; a common diplomatic representation abroad, of necessity little else than Prussian; and to Prussia also was entrusted the management of the posts and telegraphs in the confederation.

The southern German states, which up to this point had not joined the bund, were Bavaria, Baden, Würtemberg, Hesse-Darmstadt, and Liechtenstein, with a joint area of 43,090 sq.m., and a total population (1866) of 8,524,460. But though these states were not formally members of the bund, they were so practically, for they were bound to Prussia by treaties of alliance offensive and defensive, so that in the event of a war the king of Prussia would have at his disposal an armed force of upwards of 1,100,000 men.

In the spring of 1867, a war between Prussia and France seemed imminent from difficulties arising out of the occupation of Luxembourg by the former; but by the good offices of the British government, a congress was assembled at London, at which

representatives of the great powers (Italy included) were present, and an arrangement satisfactory to both nations was amicably agreed upon, the province under dispute remaining in the possession of the king of Holland. Though the outbreak of hostilities was thus averted for the present, neither nation entirely gave up the thought of war, and on both sides extensive military preparations were carried on.

During the next few years, the North German confederation was employed in consolidating and strengthening itself, and in trying to induce the southern states to join the league. The Zollverein (q.v.) was remodelled and extended, until, by the year 1868, every part of Germany was a member of it, with the exception of the cities of Hamburg and Bremen and a small part of Baden. This paved the way for the formal entrance of the southern states into the confederation; but they still hung back, though it daily became more evident that united Germany would soon be an accomplished fact.

In 1870, the long threatened war between Prussia and France broke out. On July 4, of that year, the provisional government of Spain elected prince Leopold of Hohenzollern, a relative of king William of Prussia, to fill their vacant throne. This step gave the greatest umbrage to the French government, and the Paris journals almost unanimously asserted that the accession of this prince to the Spanish throne would be tantamount to the re-establishment of the empire of Charles V., in favor of Prussia. M. Benedetti, French minister at Berlin, was instructed to ask explanations from king William; and, though by the advice of that monarch, prince Leopold resigned his candidature, the French government was not satisfied, but demanded an assurance that Prussia would at no future period sanction his claims. This assurance the king refused to give; and on July 23, the emperor of the French proclaimed war against Prussia. Contrary to the expectation of France, the southern German states at once decided to support Prussia and the northern states, and placed their armies, which were eventually commanded by the crown prince of Prussia, at the disposal of king William.

Early in Aug., the forces of both countries were congregated on the frontier. Napoleon, however, lost a fortnight in delays after the declaration of war, and it was discovered that the French army was by no means in a state of satisfactory preparation, while the Germans were splendidly organized, and much superior in number. The result was, that the French, instead of marching to Berlin, as they anticipated, never crossed the Rhine, and had to fight at a disadvantage in Alsace and Lorraine.

On Aug. 2, the French obtained some trifling success at Saarbruck, but on the 4th a brilliant victory was achieved by the army of the crown prince of Prussia at Weissenburg. This was followed by the victory of Worth on the 6th, in which the French, under MacMahon, lost 4,000 prisoners, and were pursued towards Metz. On the same day, the French, under gen. Froissard, were again defeated at Spicheren, and lost 2,500 prisoners. On the 14th, the Prussians occupied Nancy, and on the 16th the French army under the command of Bazaine was driven back on Mars-la-Tour. The battle of Gravelotte, in which king William commanded in person, was fought on the 18th; and, though the Germans suffered immense loss, they were again victorious, and forced Bazaine to shut himself up in Metz. The losses of the French in these last three days' fighting amounted, in dead alone, to upwards of 12,000 men. About 4,000 prisoners were made at Gravelotte. The emperor Napoleon and marshal MacMahon in vain attempted to proceed to the relief of Bazaine. They were surrounded at Sedan, and completely defeated, with heavy loss. The emperor surrendered on Sept. 2, with his whole army, about 90,000 men, and was sent as a prisoner into Germany. By Sept. 19, the Prussians had reached Paris, and commenced a vigorous siege. Strasburg capitulated on the 27th, after a severe bombardment, and on Oct. 28, Bazaine surrendered Metz, with an army of 6,000 officers and 173,000 men, 400 pieces of artillery, 100 mitrailleuses, and 53 eagles. Verdun capitulated on Nov. 8; Thionville followed on the 24th; after which there were several captulations of lesser importance.

The French made extraordinary efforts to raise armies and relieve Paris, but with the exception of a momentary gleam of success on the Loire, they met with nothing but severe defeats. Of these, may be mentioned the battle of Dec. 3, in the forest of Orleans, and that of Le Mans, Jan. 12, in which contests prince Frederick Charles took, altogether, 80,000 prisoners. After numerous unsuccessful sorties, and enduring great sufferings from famine, Paris surrendered on Jan. 29, and the war was virtually at an end. The French army of the east, 80,000 strong, under Bourbaki, was compelled to retire to Switzerland on the 31st. France was condemned to pay a war indemnity of 5 milliards of francs, or £200,000,000; and the province of Alsace, along with the German part of Lorraine, was ceded to Germany.

A very important result of the war was to complete the fusion of the northern and southern states of Germany. As already stated, the southern states joined at once in the war against France, and in Nov. of 1870, Baden and Hesse leading the way, they all became members of the German Confederation. This was soon followed by the re-establishment of the German empire, with the king of Prussia as hereditary emperor.

The following is a list of the states composing the present German empire, with their areas and populations for 1875:

States.	Area in. sq.m.	Pop. in 1875.
KINGDOMS—		
1. Prussia	134,381	25,742,404
2. Bavaria	29,280	5,022,390
3. Saxony	5,780	2,760,586
4. Würtemberg	7,532	1,881,505
GRAND-DUCHIES—		
5. Baden	5,850	1,507,179
6. Hesse	2,962	884,218
7. Mecklenburg-Schwerin	5,136	553,785
8. Saxe-Weimar	1,403	292,933
9. Mecklenburg-Strelitz	1,130	95,673
10. Oldenburg	2,470	319,314
DUCHIES—		
11. Brunswick	1,425	327,493
12. Saxe-Meiningen	955	194,494
13. Saxe-Altenburg	510	145,844
14. Saxe-Coburg-Gotha	760	182,599
15. Anhalt	896	213,565
PRINCIPALITIES—		
16. Schwarzburg-Rudolstadt	367	76,676
17. Schwarzburg-Sondershausen	332	67,480
18. Waldeck	438	54,743
19. Reuss (ältere Linie)	123	46,985
20. Reuss (jüngere Linie)	320	92,375
21. Schaumburg-Lippe	170	33,133
22. Lippe-Detmold	438	112,452
FREE TOWNS—		
23. Lübeck	110	56,912
24. Bremen	97	142,200
25. Hamburg	158	388,618
26. Alsace-Lorraine	5,590	1,531,804
	208,613	42,727,360

The most interesting movement in Germany since the war with France, is its ecclesiastical contest with the church of Rome, which owed its immediate outbreak to the pope's refusal to receive the German ambassador in 1872. This was followed by the expulsion of the Jesuits from Germany; an act to which the pope replied by an allocution asserting the supremacy of the laws of the church over those of the state. The Falck laws, whose general principle is, that all religious societies are subject to the laws and supervision of the state, were then passed, and several German prelates, protesting against their principles and provisions, refused to submit their ecclesiastical arrangements to the inspection of the government, and threatened to excommunicate such of the clergy as should comply. The matter admitting of no compromise, the government resolved to carry out the laws, and several of the refractory bishops were expelled from Germany. In 1875, Germany passed a law making marriage a civil rite, and the pope issued an encyclical letter declaring the Falck laws to be invalid. For the connection of the old Catholic movement, see article DÖLLINGER. The serious disorganization that ensued in the affairs of the church led in 1878 and 1879, under the more conciliatory auspices of the new pope, Leo XIII., to attempts at a compromise or *modus vivendi* between the empire and the papal see—at first without effect. Meanwhile the struggle of the state with socialism had taken the foremost place in public interest. The repeated and partially successful attempts on the life of the emperor in 1878 were attributed, more or less directly, to the socialistic organization which had of late notoriously been increasing in strength; and the attempted assassination was the signal for legislative measures giving the administration very extensive powers to be used for checking or suppressing the influence of socialism.

Money, Weights, and Measures.—Since 1873, the unit of reckoning is the mark (of 100 pfennigs), equal to 1*s*. English. The standard is an imperial gold coin of 10 marks. For weights and measures, the French metrical system has been adopted.

GER'MEN (Lat. a sprout), or O'VARY, the lowest and thickened part of the pistil (q.v.) of a flower; containing in its cavity the rudiments of the seeds called *ovules* (q.v.), attached to the *placenta* (q.v.) often by *umbilical cords* (q.v.). There is often only one ovule in the germen; sometimes it consists of a number of *carpels* (q.v.), with one ovule in each; occasionally the cavity of the germen is divided into cells, each of these containing one, and often many ovules. When there are many ovules, some of them are generally abortive. The germen is sometimes *superior*—that is, it is *free* in the centre of the flower, as in the poppy, stock, and carnation; occasionally *inferior*, the calyx being adherent to it throughout, and the upper part or limb of the calyx thus seeming to arise from its summit, as in the gooseberry, rose, campanula, and snowdrop; sometimes it is half inferior, as in *saxifraga granulata*. The germen develops itself into the

fruit (q.v.), after the flowering is over. Some plants bend their flower-stalks to the ground after flowering, press the germen into the ground, and ripen their fruit in the earth, as a species of clover (*trifolium subterraneum*), and the ground-nut (*arachis hypogæa*). See ARACHIS.

GERMERSHEIM, a t. of the Bavarian Palatinate, on the left bank of the Rhine, 8 m. s.w. of Speier. The site is marshy. The town, founded in 1276, fell into the hands of the French in 1644, by whom it was restored to the elector Palatine at the peace of Westphalia; but it was again taken by the French under Turenne in 1674, when the walls were demolished; and again in 1688. The peace of Ryswick restored Germersheim to the Palatinate. There is some trade in corn, hemp, flax, etc., and a fishery. Pop. '75, 6,456.

GERMINA'TION (Lat. sprouting), the beginning of growth in a seed, or of the vital action by which it is converted into a new plant. See SEED; and, as regards acotyledonous plants, SPORE.

GERM THEORY OF DISEASE. A precise definition of the term germ theory of disease is difficult, but in general there are three theories, viz.: the vegetable germ theory, the bioplasmic germ theory, and the physico-chemical theory. The vegetable germ theory, however, is the one usually referred to when no distinction is made. This theory holds that the vegetable organisms of fungoid and algoid forms are the active agents in producing disease by multiplying within the animal organism, and that the vegetable organisms are the descendants of previous organisms; consequently this theory is distinct from that which holds that the organisms are produced by spontaneous generation. This latter theory is, in reality, the physico-chemical theory. The vegetable germ theorists, therefore, believe that all diseases which can be shown to proceed from the introduction of vegetable organisms (and they claim that these are numerous) are epizoötic. The bioplasmic theory has its chief advocate in Dr. Lionel S. Beale, who is probably the most accomplished living microscopist. His theory, which has many believers among scientific men, may be briefly stated as follows: Under certain circumstances which may not be perfectly understood, but which nevertheless can be shown to exist, and whose results can be demonstrated, there takes place an abnormal development of bioplasmic particles in the tissues and in the fluids, as from certain injuries, or inflammations resulting from exposure, or pathological states resulting from starvation or other agencies. A degradation of the bioplasmic particles or of the living matter, as bioplasm is called, takes place, and an abnormal organism is formed which has the power of growing and multiplying in suitable pabulum, such as the fluids or tissues of the animal system into which it may be introduced. There are many physicians who do not, however, accept either of these doctrines exclusively, believing that there is evidence that some diseases are produced by vegetable germs, or at least that the principal lesions in some diseases are produced by the multiplication of such germs in quantities which interfere with the circulation, and perhaps thus produce pathological conditions sufficient to account for the other symptoms of the disease. They also believe that the bioplasmic theory accounts for many contagious specific diseases, while in some cases both causes may operate together, or, at least, in the same body, and, moreover, that putrescent fluids containing no discoverable organisms, except perhaps granular bodies, have the power of producing morbid lesions, although perhaps not of so specific a character as that which obtains in some diseases; but this is a matter which is by no means settled. The belief in the power of a septic poison from anything more than a chemical organization, constitutes what may be called the purely chemical theory of disease, and, of course, has no relation to germs whatever.

Extended and laborious investigations have been made for many years, and much valuable knowledge has been acquired; but, as intimated above, much more knowledge, particularly of the natural history of the organisms which are held to be the cause of disease, and of the circumstances attending their development, as well as those by which the diseases are ushered in, is needed; yet, notwithstanding the deficiencies that may exist, it may be assumed as proved that the action of organized particles, or germs, is the cause of a sufficient number of pathological conditions to justify the assertion that the term germ theory of disease is well founded. The various opinions as to the particular manner in which the germs act, or whence they are derived, do not alter the question as to the propriety of the title; and it would be difficult to conduct any lengthened discussion in pathology or medical practice without assuming that living germs are propagators of disease, so widely is the theory accepted. The doctrine may be said to date back at least two centuries, but till recently it was supported by little more than hypotheses, as it was not possible until a considerable degree of perfection had been attained in the construction of the microscope, and until repeated experiments of various kinds had taught great caution as to this explanation, that a sufficient number of scientific facts could be collected to furnish a basis for demonstration of a theory. In 1839, sir Henry Holland advocated an animalcular theory, and in 1847, Dr. J. K. Mitchell of Philadelphia published a volume in which he advocated the doctrine that malarial and epidemic fevers are produced by the introduction into the system of cryptogamic organisms. Before this, Linnæus, the great Swedish botanist, broached a similar hypothesis. The germ theory of disease, however, as a theory, began to be

developed between 1840 and 1850. About the latter date, MM. Rayer and Davaine of France discovered microscopic bodies in the blood of animals affected with anthrax, which they described as being about twice the length of a red blood-globule. Afterwards, in 1857, Brauell found multitudes of rod-like bodies in the blood of men, horses, and sheep dying of anthrax, and he also found them in the blood of diseased animals, from one to ten days before death. But he did not find them in the blood of convalescent animals, which circumstances caused him to regard these organisms as yielding valuable diagnostic and prognostic information; but he also came to the conclusion that they did not themselves constitute the poison of anthrax, and that they were not even the carriers of it, because he infected animals with blood which, as he said, did not contain them. Davaine, in 1863, pronounced the rod-like bodies to be *bacteria*, and afterwards called them *bacteridia*, to distinguish them from the bacteria of putrefaction. He showed that bacteridia were always present in anthrax. According to prof. Otto Bollinger of Munich (*Ziemssen's Cyclopædia of Medicine*), anthrax organisms are found on soils containing much decaying vegetation, as peat moors, dried-up ponds and freshly turned up soils, where intermittent fever prevails; such sections have been termed anthrax districts; but he also says that in many of these there is no intermittent fever, and also that this disease often prevails where there is no anthrax. Bollinger, however, remarks that although the microscope may show that no rod-like bacteria may be present in infectious blood of diseased animals, he has always found the germs present in the form of spherical bacteria.

The germ theory of disease, therefore, may be said to have commenced with the discovery of bacteria in the blood of diseased animals and men. What are these bacteria? They are small microscopic bodies having various forms, sometimes existing in innumerable quantities in putrescent fluids, especially blood and urine, and often found, both before and after death, in vast numbers in the blood of living animals having certain diseases. They are also found in limited numbers in the blood of animals apparently in health. They vary in size as well as in form, some requiring the highest powers of the microscope for their recognition. They have been classified under different names, the classifications of Cohn and Billroth being the best known. The outlines of Cohn's classification are as follows: They belong to the family *phycochromacœa*, in the natural order SHIZOSPOREÆ. He divides them into four groups, and also into six genera, whose relations are exhibited in the following table:

Group I.	Sphæro-bacteriæ	Genus 1. Micrococcus.
Group II.	Micro-bactèria	Genus 2. Bacterium.
Group III.	Desmo-bacteria	Genus 3. Bacillus. Genus 4. Vibrio.
Group IV.	Spiro-bacteria	Genus 5. Spirillum. Genus 6. Spirochæta.

Of these genera the bacterium, vibrio, spirillum, and spirochæta were contained in the vibriona family of Ehrenberg. Cohn regards the ferment of contagion to be due to the presence of a variety of sphæro-bacteria, the micrococci of Hollier. The whole group sphæro-bacteria is divided into three sub-groups, viz.: 1. Chromogen; 2. Zymogen; and 3. Pathogen, which are, respectively, the micrococci of pigmentation, of fermentation, and of contagion. These organisms are too small to be susceptible of measurement. Among the pathogen micrococci are the *M. vaccina*, which have been described by Chauveau and Sanderson as present in vaccine lymph; the *M. diphtheriticus*, and the *M. septicus*, found in the miliary eruption of typhus fever, pyæmia, and other diseases. The true bacteria, as they are sometimes distinguished, or the bacteria of putrefaction, are divided into two species, the *bacterium termo*, and the *bacterium lineola*. The B. termo is a small, dumb-bell shaped body, from $\frac{1}{5000}$ to $\frac{1}{12000}$ of an in. in length, having a slow, vacillating motion. The B. linolea is larger and more active. It is rod-shaped, and is the ferment found in sour milk. The desmo-bacteria differ from the true bacteria by being occasionally united in chains. The group is divided into *bacillus* and *vibrio*. The bacilli are divided into three species, viz.: 1 *Bacillus subtilis* (the vibrio-subtilis of Ehrenberg), a thread-like form, found in stale milk—length about $\frac{1}{500}$ of an inch. 2. *Bacillus anthracis* (the bacterium carbuncolare of some writers), which is described by Davaine as an immovable, oblong, highly refractive body, found in the blood of animals affected with anthrax, varying from $\frac{1}{10000}$ to $\frac{1}{1000}$ and even $\frac{1}{2000}$ of an inch in length, and occasionally found in chains of two or three links. The vibrios are distinguished from all the preceding genera by their rotary motion. (It is convenient to state here that the word bacterium is a slight change of the Greek *Βακτήριον*, a small staff, rod, or cane. The Latin word for the same is *bacillus*, whence the use of these words to denote these rod-like organisms.) It is claimed that within the last two years the experiments of Koch, Pasteur and others have demonstrated that various specific diseases are caused by different species of bacteria. The swine-plague is one of these, and the report of Dr. J. H. Detmers, of Chicago, Ill., to the commissioner of agriculture, is an interesting document, presenting many cogent arguments in favor of the vegetable germ theory of disease, but it is probable that the time has not yet arrived to accept, as final, the conclusions to which, with others, he has arrived. The result of some of his experiments showed "that an inoculation with bacilli and bacillus germs cultivated in so

innocent a fluid as milk, will produce the disease with just as much certainty as an inoculation with pulmonal exudation from a diseased or dead hog; second, that an animal that has been afflicted with the plague has not lost its susceptibility, but may contract the disease again, though probably in a milder form." It appears, from the experiments of Dr. Detmers, which have been confirmed by Dr. Law, of Cornell university, that the special contagion of swine-plague may be communicated to other animals. Dr. Detmers inocculated two heifers with fluids containing the bacilli of swine-plague, and produced the characteristic symptoms and post-mortem appearances of the disease; and he states that he regards the results of his experiments as sustaining the opinion, "that although cattle are not as susceptible to the plague as swine, it may be transmitted to them in a mild form by inoculation." He remarks that the swine-plague bacteria are not always found in great abundance in the blood, because they lodge in the congested parts, blocking up the capillaries and smaller blood-vessels, producing emboli and ulcerous tumors. In such places the organisms are found in great numbers, and also in the lymphatic glands and kidneys. They are also discharged by the intestines, the lungs, and the skin. He found that the plague was communicated from herd to herd by the contamination afforded by running streamlets in which the bacteria were held in suspension, derived from excrements, or from the carcasses of dead animals which had died of the disease. Speaking of measures of prevention Dr. Detmers remarks: "No authenticated case of a spontaneous development of swine-plague has yet come to my knowledge, and the disease, I am more convinced than ever, can be stamped out, but only by adopting the most stringent measures." The experiments of Dr. Law demonstrate the fact that the swine plague may be transferred to sheep and rats, and then transferred back to the hog in an intensified form. Virus was taken from a pig which had been infected from that of a sheep, and a second pig was successfully inoculated, the post-mortem appearances and microscopic examinations furnishing the usual evidence of the presence of the disease. Several successful experiments of the same kind were made. These experiments were followed by inoculations of rats which were infected with all the symptoms of the plague. Virus taken from these rats was employed in successfully infecting pigs in return. Dr. Law is now engaged in a series of experiments to determine whether mild inoculations may not produce a mitigated form which may procure immunity from a second attack. (See SWINE PLAGUE).

The bioplasmic germ theory of disease of Dr. Beale has not received at the hands of many the favorable attention which it deserves. It will be proper to give some notion of the distinguished author's views, and chiefly in his own words. In his work called *Disease Germs* he says: "Vegetable germs are found in the tissues during life in a state of health—on the mucous membrane of the mouth, they invade the tissues and the intestines, but the living germinal matter of the tissues is probably perfectly free from vegetable germs." "In very many different forms of disease these bacteria germs, and probably of many fungi, are to be discovered in the fluids of the body, but the evidence yet adduced does not establish any connection between the germs and the morbid process." "Germs, apparently of the same nature as those of cholera, are invariably to be found in the old epithelial cells in the mouths of healthy persons, and not rarely in those from many other surfaces. In the intestinal canal, in various slight derangements, they are common enough, so that we cannot but conclude that their presence is due, rather to alterations in the fluids consequent upon morbid changes, than that they are themselves the cause of the disease. They follow the morbid change instead of preceding it;" and it is his opinion that bacteria germs grow and multiply whenever a condition in the animal system favors the production of a pabulum suitable for their development. "From the fact that bacteria grow and multiply, not only in a few special fevers, but in a great variety of different morbid conditions, it is evident that they have nothing to do with any peculiar form of disease." In a chapter discussing "*some difficulties which prevent us from accepting the vegetable germ theory of disease.*" Dr. Beale says: "If contagious diseases are due to the entrance into the organism of such minute vegetable germs as those described, is it not wonderful that we escape disease? Minute vegetable germs, resembling those to which contagious diseases have been attributed, are everywhere, though they may easily escape observation. If, however, the pabulum adapted for them be present, and the conditions favorable to their development exist, they soon grow and multiply, and abundant evidence is afforded of their presence." Explaining the nature of disease germs, as he conceives them to be, he says: "I consider it to be almost certain that the material of which these particles are composed has the power of forming matter like itself from pabulum around it, which differs from it in properties and composition. Such living germs may pass from the organism on which they grow to another, and will grow and multiply there if they meet with the proper pabulum." "Upon the whole, then, I venture to conclude that the millions of contagious particles produced in the organism in an eminently contagious disease are all the direct descendants of the very few, or perhaps even, the single particle first introduced; just as the millions of bacteria and fungi developed in certain decomposing organic matters in the course of a few hours may have been produced from one, or at most, a very few particles." It must be admitted that these statements, coming as they do from a microscopist of long experience, and who uses, with consummate skill, lenses having a magnifying power of 5,000 diameters, deserve the most

respectful consideration.. It appears to be admitted on all hands that some diseases appear to be generated by inoculation with fluids in which the highest powers of the microscope fail to reveal any organisms whatever, and that in other cases all that can be seen is granular matter, so minute in its particles that their form cannot be made out; and yet, in view of the fact that specific diseases, exhibiting well marked pathological characteristics, are produced by such fluids, it must be held that some definite organism is present, and surely such organism must be regarded as a germ. Dr. Beale says that fungoid matter is found within bioplasmic cells. Why, then, may not fungoid cells growing in certain localities contain within themselves certain poison, obtained from the soil in which they grow, capable, when introduced into the animal organism, of producing disease, the vegetable cell acting merely as a carrier? From the investigations of Drs. Klebs of Prague, and Tommasi of Rome, it appears that a certain form of fungus generates fever and ague, and it also appears that another kind of vegetable organism, discovered by Dr. Salisbury of Cleveland, O., has the power of generating the same disease. If these are not identical plants how can their action be explained unless it be supposed that, although the plants differ, they contain the same contagious or disease-producing principles? But Dr. Salisbury has found in the same locality plants of different species which produce, in his opinion, intermittent fever (q.v.). Is it not, therefore, probable, in view of all the facts which have been collected by competent investigators in all parts of the world, that vegetable spores are often the carriers of disease germs? It is well known that vegetables which have been grown with manure, containing quantities of undecomposed feculent matter, are capable, when eaten, of producing disease. Why, then, may not fungi flourishing in localities infected by animals or men, contain within them disease germs which have either been preserved in the soil, or have multiplied from generation to generation? In the fen or morass, disease germs probably remain undecomposed an indefinite period of time if they are far enough beneath the surface, and covered with water. When the shrubbery is cleared away and the surface becomes dry, they spring into activity and generate disease. They may be deeply buried in the earth, and even be hidden in the seams of rocks, and remain harmless until an excavation for a railroad or for building brings them to the surface, where the conditions favorable for their growth exist. The opinion is held by many learned and practical physicians that drinking water obtained from swamps or any localities where the soil contains the poison of malaria, is capable of producing fever and ague, even when filtered, believing the miasmatic contagium to be soluble. But whether, or not, malarial diseases may be propagated independently of vegetable organisms, as vehicles, they are almost certainly propagated by such means as has been before remarked in this article, and in the article intermittent fever (q.v.). In badly sewered quarters of a city, where typhoid fever and diphtheria prevail, the pabulum for the growth of vegetable organisms is furnished, often abundantly, and bacteria flourish and no doubt spread the poison of these diseases; but that they constitute, in themselves, the poison, is by no means demonstrated. Cryptogams flourish everywhere, but only in certain localities do they produce disease. We are almost forced to the conclusion that the real disease-poison, whether an organism or not, is independent of the other organism, the visible vegetable cell. Adopting this hypothesis, we readily explain the non-appearance of some diseases amongst us. For example, the Russian cattle plague has never visited the United States. If it were produced by cryptogamic organisms, or any other organisms of appreciable dimensions without any contamination of associated virus, it would not be easy to conceive that it should not be generated here. So of the pleuro-pneumonia of cattle; this disease was unknown in this country till 1843, and the history of its importation is known. Is it to be supposed that the vegetable organism which may be found associated with the disease did not exist here previous to the introduction of the disease? But the subject is an exceedingly difficult and complex one, and many circumstances may be used as arguments on either side of the question, which may, after all, require for its solution the application of the reasoning powers as well as the processes of physical science.

The soil where armies had their camping grounds thousands of years ago, or where large cities flourished, may contain germs of disease which have not yet undergone decomposition; for it is known that germs, as in the seeds of plants, may retain their life for thousands of years under favorable circumstances. That human diseases have a human origin, as a rule, or in some instances an animal origin, is not at all improbable. The fact, for instance, that small-pox is produced by the contagion of a previous case of small-pox supports that view. It cannot be shown that small-pox was ever sporadic, and to believe that algoid or fungoid organisms must be present to generate it is inadmissible, for vaccine lymph was so prepared by Chauveau as to be completely free from all organic cells, and still it retained the properties of a virus capable of transmitting the disease. The fluid, however, was granular. Panum, with a view to test the nature of septic poisons, boiled putrid septic fluid, and, as he claims, eliminated all the bacteria by repeated filtration, and yet the clear solution was capable of producing septicæmia. But it is quite possible that vegetable germs are often convenient carriers of disease, and it may be the only way in which some diseases are propagated, as, for instance, anthrax; and, moreover, it is possible that in this disease, and in some others, it is the vegetable germ itself which produces all the pathological conditions. The

problem has not been solved. Some medicines, mineral as well as organic, are capable of producing certain specific pathological conditions without the aid of any organisms. Arsenic will produce, when taken internally, peculiar eruptions resembling urticaria, ptyriasis or psoriasis. Mercury will produce a peculiar condition called salivation, in which the germs assume a characteristic appearance, accompanied by other well known diseased conditions. It is also capable of producing an eruption on the skin like that of eczema, and sometimes like that of measles. The internal administration of the common nettle is followed by a peculiar vesicular eruption. Is it to be denied, in the light of such facts, that a septic poison, or any species of virus capable of producing specific pathological conditions, may be engendered in the blood without the introduction of organisms? That one disease *may*, with great probability, be generated by vegetable disease germs does not at all warrant the conclusion that other diseases are so produced, especially when it is observed that they are produced by contagion, and never sporadically. As to the probability of those diseases which are peculiarly epidemic being produced by vegetable organisms, unassociated with other disease-producing virus, it is doubtful if a positive opinion can be well founded. Indeed, the very facts which are brought forward to show that vegetable organisms are the generators of specific diseases rather favor the contrary conclusion; as, for instance, the fact, before alluded to, that different species of algoid or fungoid organisms are capable of engendering intermittent fever.

But what are disease germs? It cannot be doubted that the molecules of any compound, even of the most simple, inorganic, are aggregations of atoms—for otherwise we cannot conceive of the nature of a compound—and they must possess dimensions according to the complexity of the molecule. But when we come to consider complex organic molecules, we necessarily have in our minds bodies of much larger dimensions than simple, inorganic molecules, which latter probably contain only a comparatively small number of atoms. Whether it be possible for a microscope of the highest power, to reveal a complex organic molecule like that of a proteid body, is, perhaps, a question difficult to settle. How near we come to the discovery in magnifying 5,000 diameters it is impossible to form an opinion. It is improbable that the powers of the microscope will ever penetrate into the molecular constitution of vital matter to that profound depth, in which the organic molecule is so elementary, as to be incapable of a vitality of its own while surrounded by a proper pabulum; for if the instrument could ever be given sufficient power, it would probably reveal the fact that the smallest organic molecule, even the ultimate, is a moving, living body, capable of growing and multiplying in its natural pabulum. It is therefore probable, that if such be the relation of vitality to organic molecules, the continued increase of the power of the microscope would only reveal the existence of minuter and, still minuter bioplasmic bodies, previously invisible. If disease germs can proceed from bodies which are invisible with the highest microscopic power, what organism is it which shall receive the designation of original disease germ? It may be that the ultimate molecule of living matter is as independently active as the aggregation of them which we call bioplast, and it may be asked how minute must be the bioplasmic particles, or the germinal particles, and, how simple in constitution, before they lose their power of development and multiplication. Like the starry heavens, which only reveal more worlds with the increase of telescopic power, living, organic fluids seem to contain an almost infinite gradation of minute and more minute bodies. But wherever life begins and life ceases, there are boundaries between living and dead matter which seem impossible unless the particles are carried over by a power which is exclusively external, and which either confers vitality or destroys it. Is the organism which produces disease as a cell, an organic particle, or a simple poison without any organization consistent with vitality? Whatever it may be, the fact that it is capable of producing a repetition of pathological phenomena of a specific character compels us to regard it as germ-like, and, therefore, as practically a germ.

It can scarcely be doubted that many specific diseases are caused by the introduction into the system of specific germs; but how many diseases are there which come strictly under the denomination of specific? Is diphtheria, for instance, a strictly specific disease, produced by the introduction into the system of specific disease germs, and which produce this disease, and no other? It is doubtful if this question can be confidently answered in the affirmative. Diphtheria is rather a protean disease: assumes various forms, has variable symptoms, runs no specific course, and has no definite, or anything like a definite, period of incubation, although it is attended by the development of fungoid organisms. That it is contagious there is scarcely a doubt, and this may be regarded as strong evidence of the specificity of the contagion. The question is very difficult, and it is probable that the most which can now be said is that diphtheria is the product of a virulent poison, which may be in the form of a gas, or a vapor, sometimes introduced from the sewer, sometimes from the cess pool, sometimes generated by the garbage pile or the compost heap of the farm-yard, sometimes taken from the well, whither, dissolved in water, it has drained through a porous soil from the adjoining privy or cess pool. Whether the organisms that sewer and cess-pool gases and vapors are known to carry are the peculiar disease germs, has not been decided, although it is exceedingly probable that the inflammatory lesions which often take place in this disease, and which contain bacteria, are caused by the plugging up of the capil-

laries, as in anthrax. It is quite possible that in both these diseases there are two elements, that of the growing organism, mechanically interfering with the circulation, and that of a separate poison, which is the peculiar malignant principle, but which may also be the product of the growth of the organism, or may precede it, and prepare the way for its development. While these questions have not been settled, there are many facts in regard to the propagation of many diseases which are well known, and of the greatest practical value. It is known that the progress of diphtheria may be arrested by the use of a solution of carbolic acid, and that, in general, disinfectant remedies and a blood-enriching and supporting treatment is beneficial. It is also known that negligence, which ought to be regarded as criminal, on the part of public officers, is one of the chief causes of the bad sanitary conditions by which the disease is propagated. When the majority of the community recognize the fact that sewers should be so constructed and so connected with dwellings as not to be the injectors of poisonous vapors and gases, and when they are also fully convinced of the great impropriety of collecting drinking water from pasture fields, swamps, and ditches, which not only contain many animals and receive and transmit to the reservoir much of their excreta, but also receive the drainage of farm-yards and hog pens; and when they are also convinced of the danger of collecting it from streams which receive the sewerage of villages, the remedy for these evils will certainly be forthcoming, especially when neighboring sections of country are of such formation as to afford facilities for the excavation of wells and channels by means of which pure, filtered water from vast gravel beds can be obtained in great quantities.

GEROME, JEAN-LÉON, one of the most eminent of living French painters, was b. in 1824 at Vesoul, where he received his early education. His father was a goldsmith. In his seventeenth year, he went to Paris, and entered the studio of Paul Delaroche, at the same time attending the school of the fine arts. He continued till 1844 the pupil of Delaroche, whom, in that year, he accompanied on a tour in Italy. In 1847, one of his pictures was exhibited at the Louvre. In 1851, he was commissioned to furnish a design for a vase which was to be manufactured at Sèvres in commemoration of the London exhibition of that year. In 1853, he traveled in Turkey and upon the eastern waters of the Danube. He has since extended his knowledge of eastern scenes by a journey in Egypt and the adjacent countries in 1856. In 1855, he received the cross of the legion of honor; and in 1863, he was appointed professor of painting in the school of the fine arts, a position which he continues to hold. Many of his pictures have been exhibited in London, and there are few contemporary French painters whose works are so well known to the British public, or so high in favor with English critics. Gerome was decorated with the Prussian order of the red eagle in 1869, and made commander of the legion of honor. In 1855, his first great picture, "Le Siècle d'August et la Naissance de Jésus Christ," was exhibited; it was much canvassed by the critics, on the whole was received with favor, and ultimately was purchased by the state. This painting showed an elevated taste and a noble ambition; the execution, too, was in many respects excellent, and the work greatly raised the author's reputation. In 1859, he exibited his noble picture of Roman gladiators in the ampitheater, with the motto: "Cæsar, ave, Cæsar Imperator, morituri te salutant," which raised to the highest pitch his reputation as a colorist and painter of the human figure, while making a profound impression by the success with which the human interest of the scene was rendered. With "Phryne before her Judges," exhibited in 1861, he won fresh honors as a colorist and draughtsman. In the same year, he exhibited, among other pictures, his "Socrates searching for Alcibiades at the House of Aspasia;" "Deux Augures non jamais pu se regarder san rire;" and a portrait of Rachel. "Louis XIV. and Molière," "The Prisoner," and the "Death of Cæsar" are among the best known of his subsequent works—the last, a finely conceived and nobly painted picture, which, for its architecture, its color, and the subserviency of details very strikingly rendered to a definite human interest, demands the highest admiration. The "Death of Cæsar," the "Phryne," the "Gladiators," and "Louis XIV. and Molière," are among the pictures of Gerome which have been exhibited in London. Gerome has painted admirably several eastern subjects. His mural picture, "The Plague at Marseille," his "Death of St. Jerome," the "Lioness meeting a Jaguar," "Rex Tibicen" (1874). and "L'Eminence Grise" (1874), have received high encomiums. Though not to be ranked among painters of the first class, as a colorist and figure-painter he probably has no superior among living artists.

GERONA, a province in Spain bordering on France and the Mediterranean; 2,272 sq.m.; pop. 325,110. The surface is rough, being intersected with spurs of the Pyrenees, with fertile intervening valleys. Agriculture is the main business of the interior, and ship-building and fishing of the coast population. The Fluvia and the Ter are the only rivers of any importance. The towns of Rosas and Figueras are fortified.

GERO'NA (anc. *Gerunda*), a city of Spain, in lat. 41° 58′ n., long. 2° 50′ e., capital of the province of the same name, is situated at the confluence of the Ter, with its affluent the Oñar, 60 m. n.e. of Barcelona. It consists of an old and new town, the latter irregularly built on the declivity of a rocky hill, but highly picturesque, and containing a beautiful and lofty Gothic cathedral, commenced in 1316, and approached by a superb flight of steps. Besides the cathedral, there are 5 churches and 12 convents. The

inhabitants carry on the manufacture of paper, soap, and leather; and spinning and weaving. The city is protected by high thick walls, and 4 forts. Pop. 14,615.

Gerona was of Roman origin, and was formerly the residence of the kings of Aragon. It has suffered much from sieges, of which the most noteworthy was that of 1809, when the French with 35,000 men encompassed and assailed the town. The besieged, unprovided with everything, even with ammunition, maintained a defense for seven months and five days against seven open breaches, and were forced to capitulate only when their heroic governor was struck down by famine and disease.—The *province* of Gerona measures 2,270 sq.m. in extent, and had a pop. in 1870 of 325,110.

GEROPIGIA, or JERUPIGIA. Of late years, a considerable quantity of this material has been sent from Portugal to this country. It consists of grape juice unfermented, and coloring matter, probably the extracts of rhatany-root and logwood, with sufficient brandy and sugar to preserve it from fermentation. It is used for giving a spurious strength and color to red wines, more especially to those intended for exportation—the factitious compound being mixed or vatted with the wines in bond. At least 20,000 gallons are now imported annually, and this large trade has sprung up within 25 years.

GERRY, ELBRIDGE, 1744–1814; b. Mass.; graduated at Harvard; a member of the colonial legislature, where he became a political leader with Adams, Hancock, and Warren. He was on the committees of safety and supplies which met the day before the battle of Lexington. In 1776, he was a delegate to the continental congress, where he signed the declaration of independence, and served on several of the most important committees, especially in financial matters, until the organization of the treasury board, of which he was made president. He was again in congress in 1783, and in 1787 became a member of the convention to revise the articles of confederation. He remained in congress four years, and in 1797 accompanied Pinckney and Marshall on a special mission to France. In 1810, he was elected governor of Massachusetts, and was re-chosen the next year. In 1812, he was elected vice-president of the United States, and died suddenly while in office.

GERS, a department in the s.w. of France, is formed of portions of the old provinces of Gascony and Guienne. The department of Landes intervenes between it and the bay of Biscay, and that of Hautes-Pyrénées between it and the frontiers of Spain. It has an area of 2,420 sq.m., and a pop. (1876) of 283,546. The surface toward the s. is mountainous, covered with ramifications of the Pyrenees, which extend northward in parallel lines. These lines decrease in height as they advance, and are separated by fan-shaped valleys, which are only a few yards wide in the s., but expand to a width of several miles in the n. of the department. The principal rivers are the Gers—which gives its name to the department—the Losse, the Baisse, the Arratz, the Gimone, and the Save. The climate is healthy and temperate. The soil is a stiff loam, resting on thick layers of clay, and is only moderately productive. More than one half of the surface is devoted to agriculture, one seventh is in vineyards, and the rest in meadows, heaths, and forests. Wine is produced in considerable quantity, but of an inferior quality; great part of it is converted into Armagnac brandy, which, after Cognac, is esteemed the best. The manufactures and exports are inconsiderable. The town of Auch is the capital.

GERSON, JEAN DE, one of the most eminent scholars and divines of the 14th and 15th centuries. His proper name was Jean Charlier, the name of Gerson being given to him from the place of his birth (1363), the village of Gerson, in the diocese of Rheims. He was educated in the university of Paris, under the celebrated Peter d'Ailly. Here he rose to the highest honors of the university, and ultimately to its chancellorship, having acquired by his extraordinary learning the title of "The Most Christian Doctor." During the unhappy contests which arose out of the rival claims of the two lines of pontiffs in the time of the western schism, the university of Paris took a leading part in the negotiations for union; and Gerson was one of the most active supporters of the proposal of that university for putting an end to the schism by the resignation of both the contending parties. With this view, he visited the other universities, in order to obtain their assent to the plan proposed by that of Paris. But although he had the satisfaction to see this plan carried out in the council of Pisa, it failed, as is well known, to secure the desired union. In a treatise inscribed to his friend d'Ailly, he renewed the proposal that the rival pontiffs (now not two, but three since the election of John XXIII. at Pisa) should be required to resign; and in the new council held at Constance in 1414, he was again the most zealous advocate of the same expedient of resignation. It is to him, also, that the great outlines of the plan of church reformation, then and afterwards proposed, are due. But his own personal fortunes were marred by the animosity of the duke of Burgundy and his adherents, to whom Gerson had become obnoxious, and from whom he had already suffered much persecution, on account of the boldness with which he had denounced the murder of the duke of Orleans. To escape their vengeance, he was forced to remain in exile; and he retired from Constance, in the disguise of a pilgrim, to Rattenberg in Bavaria, where he composed his celebrated work *De Consolatione Theologiæ*, in imitation of that of Boëthius, *De Consolatione Philosophiæ*. It was only after the lapse of several years that he was enabled to return to France, and take up his residence in a monastery at Lyon, of which his brother was the superior. He

devoted himself in this retirement to works of piety, to study, and to the education of youth. He died in 1429, in his 66th year. His works, which are among the most remarkable of that age, fill five volumes in folio. Among the books formerly ascribed to him was the celebrated spiritual treatise *On the Imitation of Christ;* but it is no longer doubtful that the true author is Thomas-a-Kempis. See KEMPIS. The authority of Gerson is much relied on by the advocates of Gallican principles; but the Ultramontanes allege that the principles laid down by him, as to the authority of the pope are only applicable to the exceptional case in which he wrote—viz., that of a disputed succession, in which the claim of each of the rival popes, and therefore of the existing papacy itself, was doubtful.

GERSON BEN JUDAH, 960–1030; a Jewish rabbi, native of France, author of a commentary on the Talmud, of which only fragments remain. He was celebrated as a reformer among his own people, persuading the Jews to abandon polygamy, and to condemn the repudiation of debts.

GERSONIDES, or BEN GERSON, Levi, a distinguished Jewish philosopher and commentator, b. in Languedoc, towards the close of the 13th century. His family had long been distinguished for piety and exegetical skill, but though he was known in the Jewish community by his commentaries on certain books of the Bible, he never seems to have accepted any Rabbinical post. Possibly the freedom of his opinions, which drew upon him the suspicion of infidelity, may have put obstacles in the way of his preferment. He is known to have been at Avignon and Orange during his life, and is believed to have died at Perpignan in 1370. A portion of his writings consist of commentaries on Aristotle. His most important treatise is entitled *Milhamoth Adonai* (The Wars of God). A portion of it, containing survey of astronomy as known to the Arabs, was translated into Latin in 1342, at the request of Clement VI. The *Milhamoth* is throughout modeled after the plan of the great Jewish philosophy, the *More Nebuchim* of Moses Maimonides, and may be regarded as an elaborate criticism from the more philosophical point of view (mainly Averroistic) of orthodoxy as presented in that work.

GERSTÄCKER, FRIEDRICH, a German novelist and traveler, was b. at Hamburg, May 16, 1816. In 1837, he went to America. After spending some months in New York, he began his wanderings through the United States, sometimes as a stoker or sailor in various steam-packets, sometimes as a silversmith, a woodcutter, a maker of pill-boxes, etc., working till he had earned money enough to enable him to proceed further. He also led for a considerable period a wild adventurous life as a hunter in the forests. In 1842, he set up a hotel at Point Coupée, in Louisiana; but in 1843, a strong desire to see his friends induced him to return to Germany. Here he published his admirable *Streif- und Jagdzüge durch die Vereinigten Staaten Nordamerikas* (2 vols., Dresden, 1844). This was followed by his *Die Regulatoren in Arkansas* (3 vols., Leip., 1846), *Die Flusspiraten des Mississippi* (3 vols., Leip., 1848), *Mississippibilder, Licht- und Schattenseiten transatlantischen Lebens* (2 vols., Dresden, 1847), and *Amerik. Wald- und Strombilder* (2 vols., Leip., 1849). In his popular writings, as the *Reisen um die Welt* (6 vols., Leip., 1847), and *Der Deutschen Auswanderer Fahrten und Schicksale* (Leip., 1847), Gerstäcker contrives to rivet the attention even of the uneducated reader. In 1862, he accompanied the duke Ernest of Gotha on his travels in Egypt and Abyssinia; and on his return lived some time in Gotha. In 1867–68, he undertook the longest journey of his life, visiting North America, Mexico, Ecuador, Venezuela, and the West Indies; and published, in 1868, *Neue Reisen*, in which he gives a vivid account of them. As to novels, he published among others, *Eine Mutter*, in 1867; *Die Missionäre*, in 1868; *Die Blauen und die Gelben*, in 1870; *In Mexico; In America; Herrn Mahlhuber's Reiseabenteuer* (3d ed. 1871). He died in 1872.

GERSTER, ETELKA, b. 1856, in Hungary; received her musical education at the conservatory of Vienna. After making her debut as an operatic singer at Venice, she appeared at Berlin, where she was received with great applause. She then sang successively at Florence, St. Petersburg, and London. In 1877, she came to New York as the prima donna of Mapleson's English opera troupe, and sang during the seasons of 1877–78 and 1880–81 in the larger cities of the United States. She owes her success to a voice of much power and expression, and the conscientious dramatic rendering of the operatic characters she assumes.

GER'UND (from Latin *gero*, I carry on,) is a part of the Latin verb which, according to grammarians, declares that anything is to be done. Thus the gerund of *scribo*, I write, is *scribendum;* as, *charta utilis ad scribendum*, paper useful for writing. It is a sort of verbal noun, possessing the same power of government as its verb, but is scarcely ever found in the nominative, at least as a governing word. In French, the infinitive has almost entirely supplanted the gerund, the sole surviving remnant, we believe, being found after the preposition *en*, as *en attendant*. In English, the present participle does duty also for the gerund; as, he is *reading* novels (participle); he amuses himself with *reading* novels (gerund).

GERVAISE, or GERVASE, of Canterbury, b. 1150; was one of the monks of the priory of Christ church, Canterbury, and witnessed the burning of the cathedral in

1174. His earliest known effort was a *Tractatus de Combustione et Reparatione Dorobornensis Ecclesiæ*, being an account of that conflagration and of the subsequent process of rebuilding, written probably about 1184. This was followed about 1194 by *Imaginationes de discordiis inter monachos Cantuarienses et Archiepiscopum Baldewinum*, a detailed relation of clerical disputes which had occurred during the episcopate of Baldwin, from 1165 to 1190. Gervaise's *Chronica de tempore regum Angliæ, Stephani, Henrici II., et Ricardi I.*, brings the history down to the death of the last named; but his *Vitæ Dorobornensium Archiepiscoporum* closes with that of Reginald Fitz-Joceline. These works, which are all of them characterized by laboriousness and trustworthiness, are reprinted in Twysden's *Historiæ Anglicanæ Scriptores*. In the library of Corpus Christi college, Cambridge, there is an unpublished MS., also by Gervaise, containing a work entitled *Mappa Mundi*, and also an English chronicle from the fabulous ages to the death of Richard. The year of the death of Gervaise is not recorded, but the fact that he does not appear to have accomplished any part of his promised chronicle of the reign of John may fairly be taken to imply that he did not live long after 1200.

GERVAS (*Stachytarpheta Jamaicensis*), a small shrub of the natural order *verbenaceæ*, a native of the West Indies and warm parts of America. It has scattered hairy branches, oblong-ovate, coarsely and sharply serrated leaves about two inches long, and long dense spikes of lilac flowers. It is regarded as a stimulant, febrifuge, anthelmintic, and vulnerary; a decoction of the leaves is applied to severe contusions; and the dried leaves are used as tea. In Austria, they are sold under the name of *Brazilian tea*. In Britain, they are employed only for the adulteration of tea; but for this purpose they are perhaps more frequently used than any other kind of leaf.

GER'VASE of Tilbury, an historian of the 13th c., was born at Tilbury, in Essex. He is said to have been a nephew of king Henry II. of England. About 1208, he was received with great distinction at the court of Otho IV., emperor of Germany, and appointed by that monarch marshal of the kingdom of Arles. He died about 1218. He wrote a commentary upon Geoffrey of Monmouth's history of Britain, entitled *Illustrationes Galfridi Monemuthensis*, lib. iv.; a history of the Holy Land (*Historia Terræ Sanctæ*); a treatise, *De Origine Burgundionum;* and a history of the kings of England and France, comprised in a work entitled *Otia Imperialia*, libri tres; also known under the titles, *Mappa sive Descriptio Mundi*, and *De Mirabilibus Orbis*. MSS. of the *Otia Imperialia* are preserved in the Cottonian collection, and in the library of Corpus Christi, Cambridge. Nicolson ascribes to Gervase the black book of the exchequer (*Liber Niger Scaccarii*). Madox, who published a very correct edition of that work, makes Richard Nelson, bishop of London, the author.

GERVI'NUS, Georg Gottfried, an historian of German literature, and politician, was b. at Darmstadt, May 20, 1805. He received a mercantile education, and was for some time employed in the counting-house of a merchant in his native town. By a diligent course of self-instruction, he supplied what was wanting in his school-education, and in 1826, was so far advanced as to be ready to enter the university of Heidelberg. After completing his studies, during which a taste for history had been awakened in him by Schlosser's lectures, he became teacher in an educational institution at Frankfurt-on-the-Maine. In 1835, he was appointed a professor extraordinary at Heidelberg. Previous to this, he had published his *Geschichte der Angelsachsen im Ueberblick* (Frank. 1830), which was followed by his *Historische Schriften* (Frank. 1833). In 1836, he was appointed ordinary professor of history and literature at Göttingen. He had now begun to publish his *Geschicte der Poetischen Nationalliteratur der Deutschen* (3 vols., Leip. 1835–38). This was followed by the *Neure Gesch. der Poetischen Nationalliteratur der Deutschen* (2 vols., Leip. 1840–42). These two works were afterwards published together under the title *Gesch. der Deutschen Dichtung* (5th ed. 1871). In 1837, he was one of the Göttingen professors who signed the famous protest against the abolition of the Hanoverian constitution, in consequence of which he lost his chair, and was ordered to leave the country within three days. He first went to Darmstadt, then to Heidelberg, and in the spring of 1838, to Italy. He spent the winter in Rome, engaged in historical studies. In 1844, he was appointed honorary professor in the university of Heidelberg. From this period, his career was that of a political writer. Constitutional liberty was the object which he had in view, and for which he ardently labored. His pamphlets and writings in different periodicals exercised a very great influence over the national mind. In July, 1847, along with some others, he established the *Deutsche Zeitung* in Heidelberg, to advocate the political views of the Constitutionalists. In 1848, he was deputed to attend the diet in behalf of the Hanse towns, and was elected a member of the national assembly by a district of Prussian Saxony. After the failure of the national democratic party in Germany, Gervinus returned to his literary pursuits, the proofs of which are his suggestive work on Shakespeare (4 vols., 1849–50) and his *Geschichte des 19ten Jahrhundert* (Leip. 1853–66). *Händel und Shakespeare* appeared in 1868, and *Händels Oratorientexte* was published in 1873. Gervinus died March, 1871.

GESEN'IUS, Friedrich Heinrich Wilhelm, one of the greatest modern German Orientalists and biblical scholars, was b. at Nordhausen, in Prussian Saxony, Feb. 3, 1785, and educated first at the gymnasium of his native town, afterwards at the universities of Helmstedt and Göttingen. After having been a short time teacher in the peda-

gogium at Helmstedt, he became in 1806 a theological *repetent* in Göttingen; and in 1809, on the proposal of Johann von Müller, was appointed professor of ancient literature in the gymnasium of Heiligenstadt. In 1810, however, he received a call to Halle as extraordinary professor of theology, and was made an ordinary professor in the following year. In 1810–12, he published, in two volumes, a *Hebrew and Chaldee Dictionary of the Old Testament*, which underwent improvements in several subsequent editions, after he made a journey to Paris and Oxford in the summer of 1820, to make researches in the Semitic languages. In the two years following the publication of this dictionary, appeared his *Hebräisches Elementarbuch* (2 Bde., Halle, 1813–14), consisting of a Hebrew grammar and reading-book. This work, as it has been improved in the recent editions of Gesenius's distinguished pupil and literary executor, prof. Rödiger of Halle, and the lexicon already mentioned, are still the grammar and dictionary of the Old Testament most in use, not only throughout Germany, but in Great Britain and in America. The best English translations of the dictionary founded on the Latin edition are those of Robinson (American), and of Tregelles; the best of the grammar are those of Davies (London) and of Conant (New York). In 1815, another work was published by Gesenius on the history of the Hebrew language (*Kritische Gesch. d. Hebr. Sprache u. Schrift*, Leip.), and a treatise, *De Pentateuchi Samaritani Origine, idole et auctoritate* (Halle). Besides a translation of Isaiah with a commentary in 3 vols. (Leip. 1820–21), we are indebted to Gesenius for a larger Hebrew grammar *Grammatisch-kritisches Lehrgebäude d. Hebr. Sprache* (2 Bde., Leip. 1817), as well as for a larger lexicographical work) *Thesaurus philologico-criticus Linguæ Hebraicæ et Chaldaicæ Veteris Testamenti*), of which the first part was published in 1829, but which was completed only in 1858 by prof. Rödiger. Gesenius contributed also some papers on oriental antiquity to Ersch and Gruber's *Allgemeine Encyclopädie;* and his notes to the German translation of Burckhardt's *Travels in Syria and Palestine*, throw light on many points connected with biblical geography. He died Oct. 23, 1842, and a memorial of him appeared in the following year (*Gesenius, eine Erinnerung an seine Freunde*, Berlin, 1843).—Many of the results of the rationalizing method of interpreting the Old Testament, which characterizes all the works of Gesenius, have been unable to stand the progress of biblical science, and he has certainly been surpassed by Ewald in insight into the genius of the Hebrew language, and its bearing on the interpretation of Hebrew life and thought, as well as in all that qualifies the critic for a true historical, æsthetical, and religious appreciation of the literature preserved to us in the Old Testament. Yet his intense devotion to his favorite studies, and the advance which he made beyond all his predecessors in the establishment of more certain principles of Hebrew philology, undoubtedly entitle him to be regarded as having constituted a new epoch in the scientific study of the Old Testament.

GESNER, Johann Matthias, 1691–1761, a distinguished German classical scholar. He studied at the university of Jena, and in 1714 published a work on the *Philopatris* ascribed to Lucian. In 1715, he became librarian and associate rector at Weimar, in 1729, rector of the gymnasium at Ansbach, and in 1730, rector of Thomas school at Leipsic, where he was associated with Joh. A. Ernesti, and Joh. Sebastian Bach. On the foundation of the university of Göttingen, he became professor of rhetoric and, subsequently, librarian also. His special merit as a classicist is the attention he devoted to the explanation and illustration of the subject matter of the classical authors.

GESNER, Konrad von, a celebrated Swiss naturalist, was b. at Zürich in 1516, and died there of the plague Dec. 13, 1565. His father, who was a leather-seller, was too poor to pay for more than the first years of his education at the town-school; but John Jacob Ammianus, professor of Latin and oratory in the college, saw in the boy so much promise, that he took him into his house, and instructed him gratuitously for three years in Latin, Greek, dialectics, and oratory. He subsequently studied for three or four years at Paris, whence he was summoned back to Zürich, to become a teacher in the school in which he had derived the elements of his own education. He devoted all his spare time to the study of medicine and botany, in the hope of ultimately rising from the office of a schoolmaster to that of a professor. The hope was gratified upon the opening of the university of Lausanne, when he was appointed professor of Greek. After holding the office three years, he went to Montpellier, where he attended medical lectures, and to Basel, where, after additional study, and the usual disputations, he was admitted to the degree of doctor of medicine. He then, at the age of 25 years, returned to his native town. In a very short time he received the appointment of professsor of philosophy, which he held until his death. He likewise practiced medicine, and published, from time to time, the fruit of his studies. As, in the course of his life, he published no less than 72 works, besides leaving at his death 18 that were in progress, it will be impossible for us to notice more than a few of the most important. His first great work, the *Bibliotheca Universalis*, appeared when he was only 29 years old. It contained the titles of all the books then known in Hebrew, Greek, and Latin, with criticisms and summaries of each; and, as an index to authors who wrote before the year 1545, it remains to this day very valuable. Ten years later (in 1555), his *Mithridates, de Differentiis Linguarum* appeared, which contained histories of 130 ancient and modern languages. But by far the greatest of his literary works was his *Historia Animalium*, which was planned in six books, of which only four were completed. The

first treats of viviparous, and the second of oviparous quadrupeds (tortoises, lizards, etc.), the third of birds, the fourth of fishes and aquatic animals. The fifth book was to have contained the history of serpents, and the sixth that of insects. Each of the four published books is a folio of considerable thickness, and with closely printed pages. In this work, which will ever remain a monument of his untiring industry, he aimed at bringing together all that was known in his time concerning every animal. The information which he collected regarding each animal was arranged under eight heads, represented by the first eight letters of the alphabet. These four volumes contain the complete history, up to the middle of the 16th c., of beasts, birds, and fishes, and well entitle their author to the designation which he often received of "the German Pliny."

Botany was probably the section of natural history with which he had the greatest practical acquaintance. He had collected more than 500 plants undescribed by the ancients, and was arranging the results of his labors in this department at the time of his death. He appears to have been the first who made the great step towards a scientific classification of distinguishing genera by a study of the fructification.

GESNERA'CEÆ, a natural order of exogenous plants, allied to *scrophulariaceæ*, and consisting of herbaceous plants and soft-wooded shrubs, generally tropical or sub-tropical. They frequently spring from scaly tubers. The leaves are wrinkled and destitute of stipules. The calyx is 5-parted; the corolla, tubular, 5-lobed, more or less irregular. The stamens are generally four, two long and two short, with the rudiment of a fifth. The germen is half inferior, surrounded at its base by glands or a fleshy ring; it is one-celled, and has parietal placentæ. The fruit is either a capsule or a berry, many-seeded. There are about 120 species, exclusive of those sometimes formed into a distinct order, under the name *cyrtandraceæ* or *didymocarpeæ*, of which there are about 140. The true *gesneraceæ* are all natives of the warmer parts of America, where some of them grow upon trees. The *cyrtandraceæ* are more widely distributed.—Some plants of this order have mucilaginous and sweetish edible fruits; but it is chiefly remarkable for beauty of flowers, containing some of the most admired ornaments of our hothouses, as species of *gloxinia*, *achimenes*, etc.

GESSLER, ALBRECHT, called also, Gessler von Bruneck, was in 1300 appointed joint governor along with Berenger von Landenberg, of the Waldstädten or Forest cantons (Schwytz, Unterwalden, and Uri), by Albrecht I. of Austria. According to the traditions connected with Tell (q.v.), his oppressive edicts and wanton cruelty so enraged the inhabitants that a conspiracy was formed against him, and he was shot by Tell in a narrow pass near Küssnacht in 1307.

GESSNER, SALOMON, a German poet and artist, was b. at Zürich, 1st April 1730, and apprenticed to a bookseller in Berlin in 1749, but soon ran away from his master, and endeavored to earn a livelihood by landscape painting. From Berlin he went to Hamburg, where he formed an intimate friendship with Hagedorn. On his return to Zürich, he published *Daphnis*, which was followed by *Inkle und Yarico*, a small volume of idylls, and *Tod Abels* (the Death of Abel), a species of idyllic heroic prose poem, which, though the feeblest of all his productions, is the best known, and the one on which his claim to the notice of posterity rests. He afterwards turned his attention for several years exclusively to painting and engraving, in the latter of which arts he attained high excellence. Some of the engravings with which he illustrated his feeble poetry are said to be worthy of the first masters. In 1772, he published a second volume of idylls, and a series of letters on landscape painting. He died Mar. 2d, 1787.

GESTA ROMANORUM is the title of the oldest legendary work of the middle ages. The stories are written in Latin, and for the most part are either taken from the histories of the Roman emperors, or at least are referred to the period in which these flourished. At a later period, moralizing expositions were added, whence the work obtained the name of *Historiæ Moralistæ*. The *Gesta Romanorum* belongs to that class of works with which the monks were wont to beguile their leisure hours, and which were appointed to be read in the refectory. The stories are short, and destitute of rhetorical ornament; neither have they any dialogues or tragic incidents. Their attractiveness lies in the charm of their *naïveté* and childlike simplicity, although their artless piety often passes into a deep mysticism. Down to the 16 c., the *Gesta Romanorum* was one of the most widely read books among the learned, as the number of manuscripts and of printed impressions shortly after the invention of printing (the first was issued at Cologne, in 1472) prove. At an early period, it was translated into French, English, German, and Dutch. The oldest Dutch translation was published at Gouda by Gerard Leeu in 1481; the oldest German translation at Augsburg, by Hans Schobser, in 1489. Among the older English translations may be mentioned that by R. Robinson (Lond. 1577). Recently (1824), the Rev. C. Swan published *Gesta Romanorum, translated from the Latin, with Preliminary Observations, and Copious Notes.* The later German fabulists and novelists, such as Hans Sachs, Burkard Waldis, and others, made abundant use of this great storehouse. But soon after the reformation it was thrown into the background, and even in the monasteries, where for a long time it maintained its footing, it was at length forgotten. Recently, however, amid the general revival of interest in the literature of the past, it has received special attention. Its author has been supposed by some to have

been Petrus Berchorius or Bercheur of Poitou, who died prior of the Benedictine abbey of St. Eloi in Paris in 1362, but it is now believed that he only added the moralizings; and Grässe, in an appendix to his German translations (2 vols., Dresd. and Leip. 1842), has shown that a certain Elinandus is the author or compiler of the work. This Elinandus was undoubtedly a monk, and was either an Englishman or German. According to Oesterley, to whom we owe the first critical edition of the work (1872), the *Gesta Romanorum* took shape in England about the beginning of the 14th century.

GESTATION, in physiology, is the term applied to the period that intervenes in the mammalia between impregnation and the bringing forth of the young. The period and the number of young produced at a birth vary extremely in different mammals, but usually stand in an inverse ratio to one another. Thus, in the larger herbivora, as, for example, the elephant, the horse, the ox, and the camel, the female seldom produces more than one at a time, but the period of gestation is long; while in the smaller ones the progeny is numerous, but the period of gestation only a few weeks. In the elephant, the period of gestation extends over twenty or twenty-one months; in the giraffe, it is fourteen months; in the dromedary, it is twelve months; in the mare, upwards of eleven months; in the tapir, between ten and eleven; in the cow, nine; and in many of the larger deer somewhat more than eight months. In the sheep and goat, the period is five months. In the sow, which produces a numerous litter, the period is four months. In the rodentia, the progeny is numerous and imperfectly developed, and the period of gestation is comparatively short: in the beaver, one of the largest of the order, it is four months; in the rabbit and hare, from thirty to forty days; in the dormouse, thirty-one days; in the squirrel and rat, four weeks; and in the guinea-pig, three weeks or less. The young of the carnivora, like the young of the rodentia, are born with their eyes closed, and in a very immature condition; and in even the larger carnivora the period of gestation is far shorter than in the larger ruminantia or pachydermata; it is six months in the bear; one hundred and eight days in the lion (the period in this animal is stated by Van der Hoeven at three months); seventy-nine days in the puma; sixty-two or sixty-three days in the dog, the wolf, and the fox; and fifty-five or fifty-six days in the cat. In the marsupial animals, which, from a structural peculiarity, produce their young in a far more immature state than any other mammals, the period of gestation is very short, being thirty-nine days in the kangaroo, the largest of the marsupial animals, and only twenty-six days in the opossum. Nothing certain is known regarding the period of gestation of the cetacea. The quadrumana produce one, sometimes two, at a birth; and the period of gestation, as far as has been observed, seems to be seven months. In the human race, forty weeks is the usual period of gestation, but this period is liable to certain deviations, which are noticed in the article FŒTUS.

GE'TÆ, a people of Thracian extraction, who, when first mentioned in history, inhabited the country which is now called Bulgaria. They were a warlike people, and for a long time successfully resisted the attempts of Alexander the Great and Pyrrhus to subdue them. They afterwards removed to the n. bank of the Danube, having the Dnieper as their boundary on the e., while westward they encroached on the Roman empire, with which, from this time, they were continually at war. They were called Daci by the Romans, and their country Dacia, and are often mentioned in the literature of the Augustan era as savage and unconquerable foes. During the reign of Domitian, they overcame the Romans, and exacted an annual tribute. But in 106, their gallant king, Decebalus, was defeated by Trajan, and the people completely subdued. A Roman colony was settled in the country, and becoming incorporated with the Getæ, gave rise to a mixed race, the modern Wallachs.

GETHSE'MANE (Heb. *Gath*, "a wine-press," and *Shemen*, "oil"), the scene of our Savior's agony on the night before his passion, was a small farm or estate at the foot of Mt. Olivet, and rather more than half a mile from the city of Jerusalem. Attached to it was a garden or orchard, a favorite resort of Christ and his disciples. The spot pointed out to modern travelers as the site of the garden of Getæ corresponds sufficiently with the requirements of the Scripture narrative, and the statements of Jerome and Eusebius. It is a place about 50 paces square, inclosed by a low wall of loose stones, and contains eight very old olive-trees, regarded with pious superstition as having existed in the time of our Lord.

GETTY, GEORGE WASHINGTON, b. Dist. Col., 1819; graduated at West Point; served in various grades in the army, in the "patriot" disturbances on the Canadian frontier, in the war with Mexico, and in Indian wars. In the war of the rebellion he was with the army of the Potomac in several engagements, and was mustered out with the rank of maj.gen. of volunteers. After the war he resumed command of his old regiment, the 3d regular artillery.

GETTYSBURG, the seat of justice of Adams co., Penn., 115 m. w. of Philadelphia, at the terminus of a railroad which connects with the Northern Central at Hanover junction; pop. '70. 3,074. The city is in a fine agricultural region, and is built over several conspicuous hills. There is a Lutheran theological seminary, organized in 1826, which possesses a fine library; also the Pennsylvania (Lutheran) college, organized in 1832. There are many extensive manufacturing establishments, more especially of carriages, eight or ten churches, two banks, and three newspapers. One of the features of

the place is the national cemetery for union soldiers. It occupies 17 acres and was dedicated with great ceremony by pres. Lincoln, Nov. 19, 1863. On the brow of the hill stands a monument 60 ft. high, on which is a statue of liberty; at the base, figures representing war, peace, history, and plenty. Nearly 3,600 bodies of soldiers are buried in this cemetery. Another institution is the national homestead for the orphans of union soldiers. The Gettysburg springs have acquired wide fame on account of the medicinal characters of their waters.

GETTYSBURG, Battle of; July 1, 2, and 3, 1863. Early in May the rebel generals had decided upon a concentrated advance upon the northern states. The campaign, inaugurated by the drawn battle of Chancellorsville, had given no decided advantage to either side, and for nearly a month the opposing forces had remained in position on opposite sides of the Rappahanock; when Lee's determination to invade the north was followed by a rapid concentration of all his forces, amounting to 100,000 men. Of these, 15,000 were cavalry, and were under Stuart's command. Slowly and cautiously the vast body of men, severally commanded by Longstreet, Ewell, and A. P. Hill, proceeded by various routes in the direction of the Potomac. At Hagerstown, Md., two columns of the army amalgamated their forces and pushed on to Chambersburg, Pa., where they fell in with a third body under Ewell, who was prepared to advance upon Harrisburg. Meantime, however, the union force under Meade, fully alive to the movements of the enemy, was prepared to intercept Lee's supplies, and harass the rear of his army in every way. It was clear to the confederates, that no successful issue was possible, unless they could rout Meade, and proceed unmolested. Lee, accordingly, ordered a concentration of all his forces near Gettysburg, without any very clear notion as to the exact whereabouts of his enemy. It thus happened that when the advance guard of the confederate army was within 6 m. of Gettysburg, it was ascertained that the town itself was in the possession of the union force. The first encounter took place 2 m. n.w. of Gettysburg, with a decided advantage for the national forces, who took 1000 prisoners, but when, a few hours later, reinforcements under Hill and Ewell arrived from Carlisle, the union force was driven back, with a loss of 5,000 prisoners, beyond the town. Early next morning the struggle recommenced. Both armies had taken up strong positions, the union army having possession of *Cemetery ridge*, 1 m. s. of Gettysburg, while the greater portion of Lee's force was established on the Seminary ridge, and supported by a large corps under Ewell, 2 m. distant. The number of men engaged on either side was about equal, and amounted to between 70,000 and 80,000. The fortunes of the day varied several times, and the terrible conflict raged throughout the succeeding day with little intermission; but with the final result that Lee was forced to retreat across the Potomac, with the shattered remains of his army. The losses upon these eventful days were variously estimated, and the rebel loss has never been exactly ascertained, but it is conjectured that his killed, wounded, and prisoners were about 36,000, while on the union side the loss amounted to 23,190, of whom 2,834 were killed, 13,713 wounded, and 6,343 missing.

The battle of Gettysburg is generally regarded as turning the tide of success against the rebellion. The surrender of Vicksburg took place almost exactly at the same time, and these two disasters foreran the steady decline of the confederacy. Congress passed resolutions of thanks for the victory to gen. Meade and gen. Howard, and in a subsequent vote the name of gen. Hancock was included.

GEULINCX, Arnold, 1625–1669, a philosopher, b. at Antwerp. He studied at the university of Louvain, obtained there a doctor's degree, and afterwards remained 12 years as a successful lecturer and teacher of the classics and the Cartesian philosophy. For some reason, not certainly known but supposed to have had connection with his religious views, he was compelled to leave Louvain and went to Leyden, where he became a Protestant, and was rescued from starvation by the generosity of a friend, who also obtained for him a lectureship in the university. Entering into this work with great zeal, he continued in it until his death. He was distinguished among the followers of Des-cartes, and his writings contain germs of thought that were afterwards developed by Spinoza and Malebranche. He gave special attention to the doctrine of the relation between the soul and body. Extension and thought, the essences of corporeal and spiritual states, are, he affirmed, distinct, and cannot act upon one another. "I cannot be the author of any state of which I am unconscious, for my very nature is consciousness; but I am not conscious of the mechanism by which bodily motion is produced, hence I am not the author of bodily motion. Body and mind are like two clocks which act together, because at each instant they are adjusted by God. A physical occurrence is but the occasion on which God excites in me a corresponding mental state." He thus originated the theory of occasional causes. But this theory compelled a further advance. "God, who is the cause of the union of body and mind, is the sole cause in the universe. No fact contains in itself the ground of any other. The existence of the facts is due to God, their sequence and co-existence are also due to him. He is the ground of all that is. Apart from God the finite being has no reality." In this he led the way for Spinoza. Geulincx did not handle directly the difficult problem concerning the mode by which extended reality is perceived; yet he shows his opinion that men do not perceive extended reality, but have the idea of it from God. His most

important works are on logic, ethics, and metaphysics. They were not published until after his death.

GE'UM, a genus of plants of the natural order *rosaceæ*, sub-order *potentilleæ*, nearly allied to *potentilla*, but distinguished by the hardened, hooked styles which crown the carpels, so that the fruit becomes a bur. The carpels are dry. Two species are common natives of Britain, *G. urbanum*, called COMMON AVENS, or HERB BENNETT, a herbaceous plant, about 1 to 2 ft. high, and *G. rivale*, called WATER AVENS, about 1 foot high, both of which have the radical leaves interruptedly pinnate and lyrate, and the cauline leaves ternate, but *G. urbanum* has erect yellow flowers, and *G. rivale* has nodding flowers of a brownish hue. The former grows in hedges and thickets, the latter in wet meadows and woods, and sometimes even in very alpine situations. Both are aromatic, tonic, and astringent, and are employed to restrain mucous discharges, and in cases of dysentery and intermittent fever. The root of *G. rivale* is also used in diseases of the bladder. The root of *G. urbanum*, when fresh, has a clove-like flavor, which it communicates to ale; and for this purpose it is gathered in spring before the stem grows up. *G. Canadense*, the CHOCOLATE ROOT or BLOOD ROOT of North America, has some reputation as a mild tonic. It is much employed in the United States in diseases of the bladder. It much resembles the British species in its leaves, and has erect flowers like *G. urbanum*. A number of other species are known, natives of the temperate and colder regions both of the northern and southern hemispheres.

GEY'SER (Icelandic, *geysa*, to burst forth violently, allied to Eng. *gush*) is a term applied to the eruptive thermal springs and wells which are found in various parts of the earth's surface in evident connection with the volcanic forces at work below. The geysers in the Yellowstone (q.v.) region are probably the most wonderful of all, but the best known group is in Iceland, about 70 m. from Reikiavik, 16 m. n. of Skalholt, and within sight of the volcano of Hecla. On the slope of a low trap-hill, overlooking the wide grassy valley of the Whitae, or White river, a space of ground measuring perhaps half a mile each way is thickly interspersed with boiling or hot springs, of various sizes, from jets not greater than an overboiling tea-kettle, up to great caldrons, besides vestiges of others no longer in operation. All are surrounded by silicious incrustations, formed in the course of time by the minute charge of silica infused into the water. The chief apertures are two, respectively called the *Great Geyser* and the *Stroker* (i.e. churn), which are little more than 100 yards apart. The latter is an irregular aperture of from 6 to 8 ft. diameter, down which one may in general safely look, when he sees the water noisily working in a narrower passage about 20 ft. below. If, by throwing in a sufficient quantity of turf, he can temporarily choke this gullet, the water will in a few minutes overcome the resistance, and, so to speak, perform an eruption with magnificent effect, bursting up 60 ft. into the air, brown with the turf that has been infused into it, and diffusing steam in vast volumes around.

The appearance of the Great Geyser is considerably different. On the summit of a mount which rises about 15 ft. above the surrounding ground, is a circular pool or cup of hot water, 72 ft. across at its greatest diameter, and about 4 ft. deep, being entirely formed of silicious crust of a dull gray color. At the edge, this water has been found to be 188° F.; in the center, it is considerably higher. From the center descends a pit of 8 ft. width, and 83 ft. deep, up which a stream of highly heated water is continually but slowly ascending, the surplus finding its way out by a small channel in the edge of the cup, and trickling down the exterior of the crusty eminence. Every few hours, the water, with a rumbling noise, rises tumultuously through the pit, and jets for a few feet above the surface of the pool; by and by it subsides, and all is quiet again. Once a day, however, or thereabouts, this tumult ends in a terrific paroxysm, which lasts perhaps a quarter of an hour, and during which the water is thrown in repeated jets from 60 to 80 ft. high, mingled with such volumes of steam as obscure the country for half a mile round. If a visitor be tolerably near on the windward-side, he may catch glimpses of this grand spectacle—the eruption of a water-volcano, it may be termed—and he must needs be charmed with the beautiful jets as they curve outwards and fall, as well as impressed by the sublimity of the whole scene. When quiet is restored, the chalice, and perhaps 20 ft. of the pit, are found empty, and the visitor obtains, so far, a sight of the internal arrangements and structure of the geyser. In a little time, the water re-ascends to its usual level, and there remains for the next day or two, with only those minor disturbances which have been described.

The thermal wells and springs of Iceland may be said to be of three classes—1. Those of continual and uniform ebullition; 2. Those which, while not constantly ebullient, are liable to occasional eruptions; and, 3. Certain wells not yet particularized, which contain tranquil tepid water, but are supposed (at least in some instances) to have formerly been eruptive. It is only in regard to the second class that there is any room for doubt or speculation. To what are we to attribute the occasional eruptions?

The theory started by sir George Mackenzie, who visited Iceland in 1810, is, that steam is gathered in some cavernous recess connected with the subterranean channels through which the water rises; and that, when it has accumulated there till such time as the pressure overcomes the resistance, it bursts forth through the tube, carrying the water before it, and tossing it high into the air. This mechanical theory, as it may be

called, has lost ground since the announcement of a chemical one by prof. Bunsen, who spent eleven days besides the Great Geyser in 1846. The learned German looks for an explanation of the phenomena to the molecular changes which take place in water after being long subjected to heat. "In these circumstances,* water loses much of the air contained in it; the cohesion of its molecules is greatly increased, and a higher temperature is required to boil it. When water in this state is brought to the boil, the production of vapor is so instantaneous and so considerable as to cause an explosion. It has been found that the water of the Great Geyser at the bottom of the tube has a temperature higher than that of boiling water, and this goes on increasing till an eruption takes place, immediately before which, it has been found as high as 261° F. This peculiarity—for so it is, seeing that, in ordinary circumstances, the hotter water at the bottom would rise to the top till all was equally warm—shows that the heating of the water in the geyser takes place under extraordinary circumstances. As far as I understand prof. Bunsen, he implies that the great pressure of the column above, and perhaps some mechanical impediments to free circulation in the form of the geyser, gives these required circumstances. Such being assumedly the case, there is an increase in the cohesion of the molecules of the water constantly going on at the bottom, at the same time that the heat is constantly increasing; at length, the latter force overcomes the former—ebullition takes place—an immense volume of vapor is instantaneously engendered, and an eruption is the consequence." We have to consider this theory in an unusually curious light in connection with a small double geyser, as it may be called, which exists in the group at Reikholt, and in which each pool makes an eruption every few minutes, the other being at those times pacific.

The water of the Great Geyser contained soda in various forms; but the chief ingredients is a charge of about 31 grammes of silica to 6 gallons. This forms the incrustations around the pools, reaching to the bulk of a little hill in the case of the Great Geyser.

GFRÖRER, August Friedrich, a German historian, was born at Calw, in the Black Forest, Mar. 5, 1803. Although he studied for the church, he had lost all taste for its practical work when he completed his theological education in 1825. After spending some time at Lausanne and Geneva, where he mastered the French language, he went to Rome in 1827 to study Italian. On his return next year, he became a *repetent*, or tutor, in the theological institution at Tübingen; in 1829, he was removed to a similar situation in Stuttgart; and in 1830, he was appointed national librarian. He now abandoned ecclesiastical life entirely, and devoted himself to literature. The first fruit of his studies was a work on Philo and the Judæo-Alexandrian Theosophy in their relation to the doctrine of the New Testament (*Philo und die Jüdisch-Alexandrinische Theosophie*, 2 Bde., Stutt., 1831). This formed the first part of a larger work on the History of Primitive Christianity (*Gesch. d. Urchristenthums*), which was completed in 1838, in three other parts. Between the beginning and completion of this work, Gfrörer's views on Christ and Christianity had undergone a change, which appeared also in his History of Gustavus Adolphus and his Times (*Gustav Adolf, König von Schweden, und Seine Zeit*, Stut., 1833–37), for the first edition of that work takes at the commencement the side of the Guelphs, and towards the close, that of the Ghibellines—an impropriety which was corrected in the second edition (1844–45). After a work on the *Prophetæ Veteres Pseudepigraphi* (Stutt., 1840), Gfrörer published his *Allgemeine Kirchengeschichte* (Stutt., 1841–46). which, extending to seven volumes, brings church history down to 1305. While working at this history, he came to the conviction that the Roman Catholic is the true church, and that the Reformation originated to a large extent in misunderstanding and the ambition of princes. He was called in 1846 to the Catholic university at Freiburg, and there was drawn into manifold conflicts, which were fought again more earnestly at the Frankfurt parliament in 1848, where he was one of the most decided adherents of the party called the *grossdeutschen*. In 1848, appeared his history of the Carlovingians of Eastern and Western Franconia (*Gesch. d. ost- u. westfränkischen Karolinger*, 2 Bde., Stutt.); in 1855, the first two volumes of a work on the early history of mankind (*Urgesch. d. menschlichen Geschlechts*, Schaff.); and in 1861, the concluding vol. of *Pabst Gregorius VII. und Seiner Zeit*, 7 Bde., Schaffh.). He died in 1861. His *Geschichte des* 18 *Jahr* appeared in 1863; and *Zur Geschichte deutscher Volksrechte* in 1866. In all these works he gave emphatic expression to his views on ecclesiastical affairs.

GHADA'MES. See Gadames.

GHAMBARU, formerly a celebrated t. of Africa, in the state of Bornu, in lat. 13° 5' n., and long. 12° 5' east. During the flourishing period of the Bornuese empire, it was the favorite retreat of the kings of the country. It was taken and destroyed by the Fulahs in 1809, and since that date has remained in a state of utter ruin and desolation; so that now almost all traces of the town have become covered with vegetation, and enveloped in the surrounding forest. The most interesting relic of Ghambaru is a well

* This account of Bunsen's theory is from Dr. Robert Chambers's *Tracings of Iceland* (published in *Chambers's Journal*, 1855). A very interesting account of the geysers will be found in Lord Dufferin's *Letters from High Latitudes* (1860).

preserved portion of an ancient edifice, evidently a mosque. This mosque was built of bricks, which, although not so regularly shaped as European bricks, are in other respects said to be quite as good. Ghambaru stands in the midst of a district comprising the finest land of Bornu, and which, before the beginning of the present century, was loud with the noise and bustle of hundreds of towns and villages; now, however, it is the haunt of the elephant and the lion; the silence of solitude has overspread it, and it has sunk back into the condition of the primeval jungle.

GHA'RA, formed by the junction of the Sutlej and the Beas, the most easterly of the rivers of the Punjab, unites with the Chenab, which has previously collected the remaining three of the five, to form the Punjnud, which thus carries the whole into the Indus. The distance between the two points of confluence is about 300 miles. The Ghara is nowhere fordable at any season; and its breadth varies from 200 yards to 500.

GHASEL, or GHAZEL, a favorite form of lyrical poetry among the Turks and Persians. It is composed of not less than five, and not more than seventeen strophes of two lines each, all the second lines of which rhyme together. The last couplet always contains the real or assumed name of the author. In regard to matter, the ghasel is either purely erotic and bacchanalian, or allegorical and mystical. Western scholars regard it as the oriental sonnet. Hafiz is unsurpassed in this kind of verse, and it has also been happily imitated by the German poets, Platen, Rückert, Bodenstedt, etc.

GHÂTS, or, as usually written, GHAUTS, are buildings erected along the banks of rivers, in order to afford easy access to bathers. They are peculiar to northern Hindustan, and line the river banks in most of the great cities, more especially those situated on the Ganges. A ghât consists, in general, of a long, high building, fronting the river, to which access is had by means of several flights of steps, these latter forming the essential part of the structure, as the wall or building is only for the protection of loungers from the sun's rays. The uniformity of the long lines of steps is broken by small projections, often crowned by kiosks, which relieve the eye. "Upon these ghâts," says one traveler, "are passed the busiest and happiest hours of a Hindu's day. Escaping from the narrow unwholesome streets, it is a luxury for him to sit upon the open steps, and taste the fresh air of the river; so that on the ghâts are concentrated the pastimes of the idler, the duties of the devout, and much of the necessary intercourse of business." Though the Ganges, being the sacred river, is *par excellence* the river of ghâts, one of the most beautiful in Hindustan is that erected at Maheswar, on the Nerbudda, by Alaya Baiee, the widow of Holkar; and though Benares prides itself upon possessing the greatest number of ghâts, it is almost rivalled by Ujein and other cities. For a fuller account of these structures, see Fergusson's *Handbook of Architecture.*

GHAUTS (in English, *gates* or *passes*) are two converging ranges of mountains, which run parallel with the e. and w. coasts of the peninsula of Hindustan, and hence known as the *Eastern* and *Western* Ghauts.—1. The Eastern Ghauts extend, with an average height of 1500 ft. from the vicinity of Balasore, in lat. 21° 30′ n., a little n. of the Mahanadi, to within 20 m. of Cape Comorin. Before joining the kindred ridge at this last-mentioned point, they send forth, about 36 m. to the n. of Madras, a common spur, as it were, of both ranges, which reaches the other range to the n. of the gap of Palghatcheri. To the s. of the departure of this connecting chain, the Eastern Ghauts become less continuous and distinct. Moreover, they are nowhere a water-shed on any considerable scale, being penetrated and crossed by nearly all the drainage of the interior. —2. The Western Ghauts stretch from the s. side of the Tapti, about the same latitude as Balasore, to their junction with the kindred ridge, at a distance of 20 m. from Cape Comorin, or rather, in fact, to cape Comorin itself. Though they are generally far more continuous and distinct than the Ghauts Eastern, yet they are sharply divided by the gap of Palghatcheri, 16 m. broad—the northern section measuring 800 m. in length, and the southern 200. Their general elevation appears to vary from about 4,000 ft. to fully 7,000. The peak of Dodabetta in that portion of the Western Ghauts known as the Neilgherries, is said to be 8,760 ft. above the level of the sea. The opposite faces of these mountains differ very remarkably from each other. Landward, there is a gradual slope to the table-land of the Deccan; seaward, almost perpendicular precipices, speaking generally, sink at once nearly to the level of the sea, at a distance from it ranging from 40 to 70 m., but at one place approaching within 6 miles. From this peculiarity, aggravated, as it is, by the incredibly heavy rains which the s.w. monsoon dashes against the lofty barrier before it, the maritime strip, more particularly towards the s., presents that singular feature of the country which is known as the "Backwaters." See COCHIN. The Western Ghauts are a water-shed, for not a single stream of any magnitude finds its way through them.

GHAZIPO'RE, a city of Hindustan, capital of a district of the same name in the North-West Provinces, stands on the left bank of the Ganges, in lat. 25° 32′ n., and long. 83° 39′ east. It contains (1872) 38,853 inhabitants. The mean temperature of May, the hottest month, is 97° F.; and of January, the coldest month, 56°. The air is salubrious, owing to the porous character of the soil and the fact that there is a long reach of the river towards the s.e., whence the hot winds generally blow. Large quantities of roses are grown in the vicinity for making rose-water and attar of roses. The *district* has an area of 2,226 sq.m., and a pop. of (1872) 1,345,401.

GHAZNI. See GHIZNI, *ante.*

GHAZZA'LI, ABU HÁMID MOHAMMED IBN AHMAD, surnamed ZAINEDDIN (glory of the law), one of the most eminent Mohammedan philosophers and divines, and one of the warmest adherents of Sufism (q.v.), b. in 450 H. (1058 A.D.) at Tus, in Khorassan, the birthplace also of Firdusi, and burial-place of Harun-al-Rashid. The surname of Ghazzali was given to him, according to some, because his father dealt in *ghazal* or spun cotton. Left an orphan at an early age, by the advice of his guardian, a Sufi, he went to Djorshan, with the intention of devoting himself to study and science, as a means of support, and became the favorite pupil of Abu Nasr Ismail, an eminent teacher of the time. He afterwards betook himself to Nishapur, where he attended the lectures of the learned Imam of the two sanctuaries (Mecca and Medina) on law, polemics, philosophy, and theology, and remained till the death of his instructor. The grand vizier of Bagdad then appointed him (1091 A.D.) to a professorship at his *Nizamjé* (university), which he left four years later, in order to perform the holy pilgrimage to Mecca. On his return, he visited Jerusalem and Damascus, and remained for ten years at the mosque of the latter place, leading a studious and ascetic life. He afterwards visited Cairo, Alexandria, and other places in Africa, everywhere teaching and lecturing on religion and science, and also returned for a short time to Nishapur; but he finally went back to Tus, his native place, where he died 505 H. (1111 A.D.), having founded a monastery for Sufis, and a college for the studious.

Of the ninety-nine works written by him (most in Arabic, a few in Persian), the most famous is his *Ihjá Olúm ad-Dín* (Restoration of Religious Sciences), a work so remarkable and exhaustive, that it has been said: "If all the books of the Islam were lost, and we had only this one left, we should not miss the others" (*Haji Khalifah*). The academies of the West, however, Cordova, Morocco, Fez, etc., condemned it as contrary to the teachings of the Sunna (q.v.), and had it publicly burned. Next in importance stands his great philosophical work *Tahâfat Al-Filâsafah* (The Overturning of the Philosophers), which has survived only in Hebrew translations, and which gave rise to a warmly contested controversy between him and Averroës (Ibn Roshd). We may mention also his commentary on the ninety-nine names of God, and an ethical treatise, *O Child!* published and translated into German by Hammer-Purgstall. About one-third only of his works are known to have survived, and of these but a very small part have been published.

GHEBERS. See GEUBERS, *ante.*

GHEE, a kind of butter used in many parts of India, and generally prepared from the milk of buffaloes. The fresh milk is boiled for an hour or more; it is then allowed to cool, and a little curdled milk, called dhye, is added to promote coagulation. The curdled mass is churned for half an hour; some hot water is then added; and the churning continued for another half hour, when the butter forms. When the butter begins to become rancid, which is usually the case after a few days, it is boiled till all the water in it is expelled, and a little dhye and salt, or betel-leaf, is added; after which it is put into closed pots to be kept for use. It is used to an enormous extent by the natives of many parts of India, but is seldom relished by Europeans.

GHEEL, a well-known colony for the insane, is a town in Belgium, in the province of Antwerp, and 26 m. e.s.e. of the town of that name. It is literally an oasis in a desert; a comparatively fertile spot, inhabited and cultivated by 10,000 or 11,000 peasants, in the midst of an extensive sandy waste, called the Campine, where neither climate, soil, nor surroundings invite a settlement. There are no gentlemen's seats in the district, and the farmhouses, though neat, and generally surrounded by trees and a garden, are evidently in the hands of the poor. Their frequency shows this. They are sometimes built of brick; much more generally, they are constructed of wattled or wicker work, thickly laid over with mud or plaster, and whitewashed. A Gheel crofter's house is much larger than the dwelling of a small farmer in Scotland. The people inhabiting these seem to be about the rank of English cottagers, but are inferior in aspect, tone of character, and cleanliness of habits. The dwellings are arranged into three classes, or cordons: those of the village proper; those scattered around in its immediate vicinity; and those collected into hamlets in the more distant and least reclaimed portions of the commune, which may be about 20 miles in circumference.

Historically considered, Gheel is noticed as having been the spot where a woman of rank, said to have been of British origin, was murdered by her father, in consequence of her resistance to his incestuous passion. The pagan in his revenge gave the church a martyr. Pilgrims, the sick, the sorrowful, and the insane, visited the tomb of the Christian virgin; the last were restored to sanity and serenity. Dymphna became the tutelar saint of those stricken in spirit; a shrine rose in her honor, which now, for ten centuries, has been consecrated to the relief of mental disease, is said to have been distinguished by never-failing success, and, at all events, has collected around it hundreds of lunatics, chiefly of the poorer classes, but laboring under every form and stage of nervous malady. Formerly, besides the benefit derivable from proximity to the ashes of the saint, and from the prayers of the church, the afflicted underwent a sort of novitiate in a building adjoining the church, where they were chained to the wall, and subsequently passed under the mausoleum of their patron, etc., but now, although faith

lingers, there do not appear to be any other than the ordinary ministrations of the church to which the patients belong, resorted to as treatment.

About 1300 insane persons are lodged with the citizens of this community, or with 1000 heads of families, and are controlled and employed by them, and this without recourse to walls or ha-has, or other asylum appliances, and with little coercion of any kind. The quiet and industrious reside generally one in each family in the town, the more excited in the suburban cottages, and the most unmanageable with the laborers on the confines of the commune. The effect produced by this large body of lunatics wandering, working, displaying many of their peculiarities in the midst of a thriving sane population, who chiefly depend upon a traffic in insanity, is both striking and picturesque. In the enjoyment of comparative liberty, and of what is called the free-air treatment, these patients are, upon the whole, contented, tranquil, and healthy. Violence is rare; only two suicides have occurred in four years; and morality is less outraged than in more protected classes. Each individual is maintained for about 6½*d.* to 7½*d. per diem.* Until recently, this colony was merely a psychological curiosity: recently, the anomaly and absurdity of treating all cases alike, and independently of medical aid, have led to the institution of a medical staff, the erection of an hospital, and the introduction of many salutary alterations in the relations between the insane and their custodiers, in classification and supervision. The compatability of the seclusion of the insane with greater freedom, with domestic life, and association with the sane, have suggested the introduction of cottage asylums, as a modification in the accommodation of this class in this country. See *Gheel,* by Jules Duval (1860); *Die Irrencolonien,* by Brandes (1165); *Gheel,* by Ruědy (Bern, 1874).

GHENT (Flem. *Gend,* Ger. *Gent,* Fr. *Gand*), an important city of Belgium, capital of the province of East Flanders, is situated at the confluence of the Lys and the Scheldt, 31 m. w.n.w. of Brussels. It is divided by canals into 26 islands, connected by 270 bridges, and is encompassed with gardens, meadows, and pleasant promenades. It is surrounded by walls, pierced by seven gates, and inclosing an area eight miles in circuit, and is, in general, well built; but in the older part its quaint and fantastic houses render it in the highest degree picturesque. Among the chief buildings are the Church of St. Ravon, containing the famous "Adoration of the Lamb," by the brothers Van Eyck; the new citadel, finished in 1830; the palace of justice, built in 1844, and having a peristyle of the Corinthian order; the university, connected with a school for engineering, and for trades and professions; the Beguinage, a convent, containing about 700 nuns; the royal gymnasium; and the academy of painting. The cotton and woolen manufactures are carried on on a great scale. There are many cotton-mills, and about 25,000 workmen are employed in the spinning, printing, dyeing and weaving of cotton, woolen, and linen fabrics. Leather, paper, and carpets are also manufactured, and there are in Ghent also foundries, machine-works, and sugar-refineries. Specially noteworthy is the floriculture of Ghent, which forms a most important and flourishing branch of industry. By the Great canal, which flows into the Scheldt, Ghent is united with the sea, and it can receive into its docks vessels drawing 18 ft. of water. The new dock or basin on the n.e. side of the city is capable of holding 400 vessels. Pop. '76, 127,653.

Ghent is mentioned in history as early as the 7th century. About the year 868, Baldwin Bras-de-Fer, the first count of Flanders, built a fortress here as a defense against the Normans. Under the counts of Flanders, Ghent continued to prosper and increase, until, in the 14th c., it was able to send 50,000 men into the field. The wealth of the citizens of Ghent, and the unusual measure of liberty which they enjoyed, encouraged them to resist with arms any attempt to infringe upon their peculiar rights and privileges.. This readiness to arm in their own defense is exemplified in the famous insurrection of Jacob van Artevelde (q.v.), and other instances. For many years, it maintained a vigorous, but unavailing resistance against the dukes of Burgundy—who wished to be recognized as counts of Flanders—and the kings of Spain. In the various wars of which the Netherlands has been the battle-ground, Ghent suffered severely, and was frequently taken. In 1792, the Netherlands fell under the power of France, and Ghent was made the capital of the department of the Scheldt, continuing under French dominion until the fall of Napoleon, in 1814, when it was incorporated with Flanders in the kingdom of the Netherlands.

GHENT, Treaty of, between the United States and Great Britain, which ended the war between the two countries known as the "war of 1812." The treaty was concluded Dec. 24, 1814, two weeks before the battle of New Orleans. The main provisions were, 1st, Restoration of all territory, places, and possessions taken by either party from the other during the war, except certain islands. Public property remaining in such places at the time of ratifying the treaty was not to be destroyed or carried away, and the same engagement was made as to slaves and other private property. 2d, Article IV. provides the appointment of a commission to decide to which of the two powers certain islands in and near Passamaquoddy bay belong; and if the commission should fail to come to a decision the subject is to be referred to some friendly sovereign or state. 3d, Articles V.-VIII. provide for several commissions to settle the line of boundary as described in the treaty of 1783—one commission to settle the line from the river St. Croix to where the 45th parallel cuts the river St. Lawrence (called the Iroquois or

Cataraqua in the treaty); another to determine the middle of the water-communications from that point to lake Superior; and a third to adjust the limits from "the water-communication between lakes Huron and Superior to the most north-western point of the lake of the Woods." 4th, Article IX. binds both parties to use their best endeavors to abolish the slave-trade, as being "irreconcilable with the principles of humanity and justice." It is remarkable that the treaty fails to speak of the impressment of American seamen, a main cause of the war, and passes over the claims of the United States to participate in the fisheries, noticed in the treaty of 1783; nor does it conclude the question as to British and American naval forces on the northern lakes.

GHERARDES'CA, a family of Tuscan origin, which enacted a conspicuous part in the history of the Italian republics during the middle ages. Their vast territorial possessions lay between Pisa and Piombino. In the 13th c., the counts Gharardesca exercised a preponderating authority in the republic of Pisa, and were prominent supporters of the popular interests, in opposition to the encroachments of the nobles. In the great feud between the Guelphs and Ghibellines, they became warm partisans of the latter, and were the irreconcilable enemies of the Visconti, who headed the Guelphs. The most famous of this family, both with respect to the historical events of his career, and the appalling tragedy of his fate, is count Ugolino, whose name and fate have been invested with undying interest by Dante. Count Ugolino, more than any of his race, was possessed by a lawless ambition, and a subtle, unscrupulous spirit. Having resolved to usurp supreme power over Pisa, he formed an alliance with Giovanni Visconti, the head of the Guelphic party, who promised to supply him secretly with soldiers from Sardinia. The plot was, however, discovered, and both Giovanni and Ugolino were banished from the city. The former died soon after; but the latter, uniting himself with the Florentines and the Lucchese, forced the Pisans, in 1276, to restore him his territories, of which he had been deprived. No sooner was he reinstated in his possessions than he began to devise anew ambitious schemes. The war of the Pisans with the Genoese afforded him the opportunity he desired. In the battle fought at the island of Malora, Aug. 6, 1284, Ugolino, by treacherously abandoning the Pisans, occasioned the complete annihilation of their fleet, together with a loss of 11,000 prisoners. When the news of this disaster spread, the Florentines, the Lucchese, the Sienese, the Pistoians, and all the other enemies of the Pisan republic, gathered together to destroy it, as the stronghold of the Ghibellines in Italy. Being thus brought to the brink of ruin, the Pisans had no other resource left than to throw themselves into the arms of him whose treachery had reduced them to such misery. From the time of his election, he gave free scope to his vindictive, despotic nature, persecuting and banishing all who were privately obnoxious to him, on pretexts of state delinquency, till at length a conspiracy was formed against him, headed by his former supporter, the archbishop of Pisa. Dragged from his palace, July 1, 1288, after a desperate defense, he was thrown into the tower of Gualandi, with his two sons and two grandsons, where they all perished amid the agonies of starvation, for which reason their dungeon has since borne the ominous name of the "tower of hunger." In spite of this, the family again rose into importance; and in 1329 we find *Nieri Donavatico Gherardesca* at the head of the republican authority in Pisa. See Sismondi's *History of the Italian Republics.*

GHERIAH, or VIZIADRUG, a t. and fortress in British India in the province of Bombay, 170 m. s. of Bombay city. The town has a safe harbor on the Kunvee river. It was once the head-quarters of the most daring piracy infesting all the adjacent seas. After many attempts to break up the corsairs the reduction of the place was effected in 1756, by the English, under admiral Watson and col. Clive. It then passed under the control of the East India company.

GHIBELLINES. See GUELPHS AND GHIBELLINES.

GHIBERTI, LORENZO, a famous Italian sculptor, was b. at Florence about 1378. He was educated in art by his stepfather, a skillful goldsmith, and rapidly acquired dexterity in drawing, painting, and modeling. At the age of 19, he was selected for the execution of a noble fresco in the palatial residence of prince Pandolfo Malatesta at Rimini. Along with seven other artists, he was next chosen by the Florentine guild of merchants to compete for the execution of a splendid gate in bronze to suit that executed by Andrea Pisano in the baptistery of Florence, about 1340. The subject of the design was "The Sacrifice of Isaac," to be executed in bas-relief as a model for one of the panels. The judges found a difficulty in deciding between Brunelleschi, Donatelli, and Ghiberti, but the two former generously proclaimed the superiority of Ghiberti's design, both with respect to the art and beauty of its conception and the delicacy and skill of its execution. When Ghiberti had completed his great work, his fellow-citizens intrusted him with the execution of another gate, to emulate the beauty and colossal dimensions of the two already adorning the baptistery. From Michael Angelo Ghiberti received a noble tribute of admiration, when the great artist asserted that *the two gates were worthy of Paradise.* Ghiberti's second gate contains ten reliefs on a larger scale, the subjects in this case also being wholly biblical. The mingled grace and grandeur of these compositions are beyond all praise. Not the least of Ghiberti's merits was the success that attended his efforts to break up the conventionalism that before his day hampered the

free development of sculptural art. Among his other works may be mentioned a bronze relief in the Duomo at Florence, representing San Zenobi bringing a dead child to life, and bronze statues of St. John the Baptist, St. Matthew, and St. Stephen. Ghiberti died at Florence in 1455.

GHI'KA, a princely family, of Albanian origin, which has given many hospodars to Moldavia and Wallachia. The founder of the house was George Ghika, an Albanian by birth, who, through the favor of his compatriot, the grand vizier Mohammed Kiupruli, was raised to the dignity of hospodar of Wallachia in 1657. He was succeeded by his son Gregory Ghika, who ruled, with various vicissitudes, till 1673, and received from the emperor Leopold I. the title of prince of the Holy Roman Empire. Of subsequent members of the family, the only ones calling for special notice are Alexander, Gregory, and Helena.

ALEXANDER GHIKA X. was b. in 1795, and, through the influence of the Russian count Kisseleff, was elevated to the hospodarat of Wallachia in 1834. Nevertheless, he soon exhibited liberal and enlightened tendencies. He founded schools for primary instruction in every village, lightened the burdens of the peasantry, commenced the enfranchisement of the gipsies, and assisted in the organization of a national party, known as *Young Roumania*. Russia naturally took the alarm, and gradually, under her influence, a twofold opposition was excited against him, viz., an opposition of the extreme liberals, and also of the old boyards (the landed proprietors), who formed the tory party, and were his personal enemies; the result of which, after many intrigues and plots, was that, in 1842, he was ordered to resign his dignity by the Turkish sultan. He now betook himself to Vienna, where he lived quietly till 1853, when he returned to Wallachia, to find himself once more popular; and in 1856 he was elected "caïmacam" of the principality, which office he held till 1859. He died in 1862.

GREGORY GHIKA X., hospodar of Moldavia, b. at Botochani, in Moldavia, August 25, 1807; was appointed *hetman*, or commander-in-chief of the militia, in 1826, secretary of state in 1842, and minister of finance in 1843, under the hospodarat of Michael Stourdza. But as the system of the government became more and more Russian in its character, he resigned his functions, and passed into the ranks of the liberal opposition, of which he soon became one of the chiefs. In 1849, the sultan appointed him hospodar, in order to counteract the influence then exercised by Russia in the adjoining principality. His tenure of office may be divided into three distinct periods. In the first, his efforts at reform were crippled by the presence of Russian troops in the principalities, in violation of the convention of Balta-Liman. The second, commencing with the departure of the Russians in 1851, was marked by many excellent measures; he organized a good police system, augmented the effective force of the militia, founded schools for superior and secondary instruction at Niamtzo, Houch, Galatz, etc., promulgated an administrative code—the first great step towards the reform of abuses,—increased municipal resources, and at his own expense built aqueducts, and printed important historical MSS. The re-occupation of the principalities by Russia in 1853 suspended his labors, and resigning the hospodarat provisionally, he withdrew to Vienna, but resumed his functions in the end of the following year. The third period of Gregory's rule was initiated by the formation of a liberal ministry, by the support of which he effected, among other thing, a radical reform of the penitentiary system, the abolition of serfdom (1855), and of the censorship of public journals (1856), and the establishment of foreign merchant companies for the navigation of the Pruth and the Sereth (1856); while he also encouraged the growth of a union feeling among the Roumanian party in both principalities. His tenure of office expiring in 1856, Gregory, whose private fortune had been rather diminished than increased by his dignity, quitted Moldavia, and went to reside in France. His death occurred in July, 1857.

HELENA GHIKA, Princess *Koltzoff-Massalsky*, better known by her literary pseudonym of *Dora D'Istria*, is niece of prince Alexander Ghika X., hospodar of Wallachia, and was born at Bucharest, Jan. 22, 1829. Profoundly instructed in the classics under the care of George Pappadopoulos, she added to these, by frequent travels through Germany, France, and Italy, an extensive knowledge of modern languages and literature, and at the age of 15 commenced a translation of the *Iliad* into German, and not long after, wrote several pieces for the theater. On her marriage with prince Koltzoff Massalsky, she accompanied her husband to the court of St. Petersburg. Her first important work, *La Vie Monastique dans l'Eglise Orientale*, was published at Paris and Geneva in 1855. This was followed by two works, *Gli Eroi della Rumenia*, and *I Rumeni ed il Papato*. Her studies in Switzerland also resulted in a volume entitled *La Suisse Italienne*. She received an official invitation, in 1865, to attend the sixth centenary festival in honor of the birthday of Dante. This event she described vividly in a *Pélerinage au Tombeau du Dante*. In 1867 she went to Venice to explore the ample archives of that city; but the first thing she did was to publish *Venise en 1867*. Afterwards she showed the fruits of her researches in *Les Albanais musulmans*, and *Les Albanais en Roumanie, ou les Princes de Ghika*. In 1868, she gave some account of her own active life in *Di alcuneopere della Principessa Dora d'Istria*, a work which reappeared in 1871, under the title, *Dora d'Istria e la poesie Albanese*. Her work, *Des Femmes, par une Femme* (1864), was translated into Russian, Italian, and English.

GHILAN, a border province of Persia, consists of the south-western portion of the narrow strip of country lying between the Elburz range and the Caspian sea. It extends between lat. 36° 30′ and 38° 30′ N., and long. 48° 33′ and 50° 30′ W. It is upwards of 150 m. in length, and about 70 m. at its broadest part. The province is subject, from the lowness of the land, to frequent inundations, and during great part of the year is little better than a swamp. There are dense forests, and mulberry trees are grown for production of silk. The soil is fertile, bearing barley, hemp, hops, fruits, and great quantities of rice. Pop. estimated at 100,000. The climate is unhealthy.

GHIRLANDAJO, RIDOLPHO, 1483–1560; son of Domenico, a painter of considerable celebrity. He was certainly one of the earliest students of the famous cartoons of Leonardo da Vinci and Michel Angelo. His works between the dates 1504 and 1508 show a marked influence from Fra Bartolommeo and Raphael, with the latter of whom he was on terms of familiar friendship; hence he progressed in selection of form and modeling his figures in relief. Raphael, upon reaching Rome in 1508, desired Ridolpho to join him; but the Florentine painter was of a particularly home-loving humor and he would not embrace the opportunity. He soon rose to the head of the Florentine oil-painters of his time; and, like his father, accepted all sorts of commissions, of whatever kind. He was prominent in the execution of vast scenic canvases for various public occasions, such as the "Wedding of Giuliano de Medici," and the "Entry of Leo X. into Florence in 1515." In his early manhood he was honest and conscientious as an artist; but from after 1527 he became careless, having already accumulated a handsome property which was more than sufficient to maintain his large family of fifteen children, and his later works show great mannerism and monotonous repetition. His sons traded in France and in Ferrara; he himself took a part in commercial affairs, and at one time paid attention to mosaic work, but after completing one mosaic, the "Annunciation," over the door of the Nunziata, patience failed him for continuing such minute labors.

GHIRLANDAJO, or **CORRADI,** DOMENICO, an eminent painter of the early Florentine school, was b. at Florence in 1451. From his youth he was educated to the craft of the goldsmith by his father, who received the name of Ghirlandajo on account of his being the inventor of some silver ornaments of great elegance, in the form of a wreath or *ghirlanda*, which became the favorite head-dress of the Florentine beauties of his day. At the age of 24, Ghirlandajo abandoned working in gold, and set about qualifying himself for the calling of a painter. He lived to become not only a famous and lauded artist, but also one of the most progressive and original masters of his age. His greatest works are frescoes, but he has also left fine easel paintings, both in oil and distemper, and his composition in mosaic—or "eternal painting," as he termed it—are unrivaled for the brilliant dyes of the coloring and the delicate softness with which they are blended and graduated. The Capella di Sassetti, in Florence, contains a noble series of Ghirlandajo's frescos, illustrative of both historical and legendary incidents in the life of St. Francis. They are stongly characterized by the wonderful mastery of intense and varied human expression, which, more than accurate delineation of form, was the great merit of Ghirlandajo's paintings. The church of Santa Maria Novella is also rich in this artist's works, being adorned by a set of frescos representing scenes from the life of St. John the Baptist, many of the figures introduced being correct likenesses of some of the leading celebrities of the day. Ghirlandajo was the first artist who adopted correct principles of perspective, just gradations of shade and form, and dramatic art in grouping. Ghirlandajo died at the early age of 44, in the year 1495.

GHIUSTENDIL, a t. of European Turkey, in the eyalet of Rumili, is situated on the slope of a hill about 2 m. distant from the right bank of the Struma or Kara Su, 192 m. in direct line w.n.w. of Adrianople. It is surrounded by an old wall flanked with towers, is the see of a Greek bishop, and contains a bazaar and sulphurous baths. Pop. 10,000.

GHI'ZEH, or GIZEH (Coptic, *Tpersioi*), a village in Egypt, close to the northern border of Middle Egypt, on the opposite side of the river and about 3 m. w.s.w. from Cairo. In the immediate vicinity, the line of the great pyramids commences. See PYRAMID. Here one may still witness the process of egg-hatching in ovens, a practice which has been continued from the time of the Pharaohs to the present day. Ghizeh, formerly adorned with beautiful palaces and mosques, the pleasant retreat of the Cairo merchants, is now a mere village, and mounds of rubbish are almost the only indication that buildings of some pretension once existed here.

GHIZ'NEVIDES, a celebrated dynasty, which, in the height of its power, possessed an empire extending from the Tigris to the Ganges, and from the Sihon or Sir-Daria to the Indian ocean. The founder of the dynasty was Alepteghin, originally a slave belonging to Abdulmelek, the Samani Ameer of Bokhara, who was appointed governor of Khorassan; but on the death of his benefactor he rebelled, and proceeded at the head of an army to Ghizni, of which he took possession in 961, and for 15 years successfully withstood the whole power of the Samani (q.v.). On his death, Sebekteghin or Sabactagi was unanimously chosen as his successor. He was distinguished for his prudence and valor, and equally so for his humanity and justice. By him the kingdom was extended from the Indus to Khorassan, and from the gulf of Oman to the Amû-Daria or Jihon:

and in the latter province his son, Mahmûd, was appointed governor under the nominal suzerainty of the Samanî. Sebekteghin died in 997, and was succeeded by his younger son Ismâil; but Mahmûd the elder, hearing of his father's death, hastened to Ghizni, and assumed the reins of government in 998, with the title of sultan. In the year following, he took complete possession of Khorassan, and in 1001 commenced a series of destructive inroads into Hindûstân. Falling in with Jeypâl, the prince of north-western India, at Peshawur, sultan Mahmûd, on the 8th of Mohurrim (Nov. 26), defeated him with immense slaughter. In 1004, while on his second expedition to India, he was recalled by the news that Eylek Khân of Khashgar, who in 999 had conquered the Samanî and taken possession of their territory, was ravaging Khorassa and Balkh; on hearing which, sultan Mahmûd, leaving his conquests, returned in an incredibly short time to Ghizni, and thence proceeding without delay to Balkh, engaged in battle with the enemy, and completely defeated them. He then took possession of the country between the Sihon and the Jihon (ancient Transoxiana). In 1007 and 1009, sultan Mahmûd made his third and fourth expeditions into Hindûstân, and each time carried off an immense booty in money, jewels, and slaves. On his return to Ghizni, he made a liberal distribution from his treasures among the poor and the ministers of religion. About this time he reduced Ghûr, Gherjistân, and Khaurezm, bestowing the latter province upon Altun-Taush, one of his favorite generals. In 1024, he was engaged in his last expedition against the Hindûs, the famous expedition to Somnaut (q.v.), at the southern extremity of Guzerat. Mahmûd here obtained an enormous booty. In 1027, he received from the Calif Ul Kader a ratification of all his conquests, together with numerous titles of honor, and in the two following years having conquered Irak, Tebriztân, and Mazanderan, he returned to his capital, where he died April 29, 1030. At this time, the empire of Ghizni was at the summit of its glory, having in the short space of 69 years extended over 38 degrees of longitude and 20 of latitude. Mahmûd possessed some of the most exalted qualities that dignify and adorn human character, but they were much obscured by his sanguinary zeal for the advancement of Islam. He was succeeded by his younger son Mahomed, who in Oct. of the same year was compelled to resign the sovereignty to his younger brother, Mussaûd I. This prince was in 1037 signally defeated by the Seljûks (q.v.), who had taken possession of Khorassan under Toghrul Beg and Tchegher Beg, the grandsons of Seljûk. Though an able and warlike prince, misfortunes crowded thickly round his declining years, and in 1041 he was put to death. During his reign, the Seljûks took possession of Bâlkh, Khorassan, Khaurezm, Herât, and Irak. The sovereigns who in succession reigned in Ghizni were Mûdud (1041–49), Mussaûd II. (1049), Ali (1049–52), Abdurrashîd (1052–53), and Furrukhzaud (1053–58), during whose reigns there is nothing worthy of relation, beyond the intestine quarrels at Ghizni, and the encroachments of the Seljûks on the w. and north. The reign of Furrukhzaud, however, shed a bright luster over the expiring glory of Ghizni, for the Seljûk prince, Daoud, thinking to take advantage of the dissensions at at Ghizni, marched towards it; but on the way he was met by Nûshtekein, one of the best generals of the age, and signally defeated. Taking advantage of this victory, Nûshtekein marched into Khorassan, to recover that province, and encountering Kellisaurek, a celebrated Tûrkman chief, totally defeated him. On news of this second defeat, Alp-Arslan (q.v.) was sent by his uncle Toghrul Beg to stop the progress of the Ghiznevides; and in the battle which ensued, fortune changed sides, and Nûshtekein was totally defeated. A treaty of peace was then concluded. Furrukhzaud was succeeded by Ibrahim (1058–98), Mussaûd III. (1098–1114), Arslan Shah (1114–18), and Behram Shah (1118–52). During the reign of this last prince, the Ghûri, a tribe inhabiting the mountainous country of Ghûr, began to make inroads upon the territory of Ghizni, and growing bolder by success, attacked and took the capital itself, driving Behram Shah across the Indus. But on the retreat of part of the Ghûri to their own country, Behram Shah returned and retook his capital, making prisoner the prince of Ghûr, Seyfuddeen Souri, whom he put to death with the most refined cruelty. On learning this, the brother of the unfortunate prince, Allah-ud-deen, hastened from Ghûr, and having defeated Behram Shah, gave up Ghizni to be pillaged by his followers. Behram Shah, thus driven a second time across the Indus, desisted from all further attempts to regain his ancestral dominions, and died in 1152. His son Khosrû Shah succeeded him, and took up his residence in Lahore; but the many attempts which he made to repossess himself of Ghizni and the surrounding territory were unsuccessful. Khosrû Melek, the 17th and last monarch of the dynasty of Ghizni, occupied himself in the first part of his reign (1160–66) in extending and consolidating his Indian possessions, but subsequently his whole energies were required to repel the attacks of Shahab-ud-deen Mahommed, prince of Ghûr, who, having conquered all the territory w. of the Indus, now sought to drive the race of Sebekteghin from their last possession. In 1184, Lahore was all that remained to Khosrû Melek, and the taking of that city by the Ghûrian prince in 1186 put an end to the power of the Ghiznevides.

GHIZNI, a river of Afghanistan, loses itself, after a southerly course of about 80 m., in the salt lake of Abistada, which is 7,076 ft. above the sea. Its source is 12 m. to the n. of the city of its own name, and its mouth is about lat. 32° 35′ n., and long. 68° east. Its embankments, dating from the 11th c., are still fit for the purposes of irrigation.

GHIZNI, the city mentioned in the preceding article, stands at an elevation of 7,726 ft., on a scarped rock, which rises 280 ft. above the adjacent plain. Its natural strength has been increased by walls of 35 ft. in height, and a wet ditch. It has long been a place of importance in Central Asia, having been, in the 11th c., the seat of an empire (see GHIZNEVIDES). Some of the most interesting points in its history, however, are much more recent. In the July of 1839, Ghizni was stormed by the British under lord Keane; and in 1842, it was first surrendered to the Afghans, and then retaken by gen. Nott. Eventually it was restored, with the rest of the country, to Dost Mohammed. It is situated in long. 68° 18′ e., and lat. 33° 34′ n.—a parallel which under the influence of the remarkable altitude of the spot, yields, in winter, a temperature of about 20° Fah. below zero. The population has been variously estimated up to 10,000, fluctuating most probably with the season of the year. Ghizni is an entrepôt of the trade between Afghanistan and the Punjab.

GHO'GRA, or GHAGRA, one of the largest affluents of the Ganges, joins that river from the left in lat. 25° 46′ n., and long. 84° 40′ e., after a generally s.e. course of 600 miles. It rises in lat. 30° 28′ n., and long. 80° 40′ e., on the southern declivity of a mountain-range, which separates the district of Kumaon from s.w. Thibet. The actual source, being between 17,000 and 18,000 ft. above the sea, is hidden under perpetual snows at every season, while in winter it can scarcely be said to flow at all. Throughout the first 50 m., the torrent, tumbling as it does down deep gorges, is in many places entirely concealed by glaciers. After receiving many tributaries on both sides, it enters the great plain of Hindustan in lat. 29° 6′ n., and long. 80° 18′ e., being now, after a run of 148 m., 798 ft. above the sea. Here it has been estimated to be about two-thirds of the size of Ganges at the corresponding point of Hurdwar. Hitherto it has generally formed the boundary between Kumaon and Nepal. Before the Ghogra has descended 70 m. further, it has become navigable for craft of considerable burden. Further down, it is practicable for boats of all sizes at every season, but is here and there beset by dangerous and intricate shoals. Like other great rivers traversing alluvial tracts (see GANGES), it sends off lateral water-courses, which in the rainy season communicate with the parent-flood and with each other. The principal auxiliaries, to take them in order, are the Kalipani on the left; the Dhouli, on the right; the Gorigunga, also on the right; the Chumalea, on the left; the western Surju, on the right; the Lohogatalu, on the right; the Ladhia the last of its hill-tributaries, also on the right; the Kurnalli, on the left; the united Chonka and Woel, on the right; the eastern Surju, on the left; and finally, the Rapti, also on the left.

GHOR. See EL-GHOR.

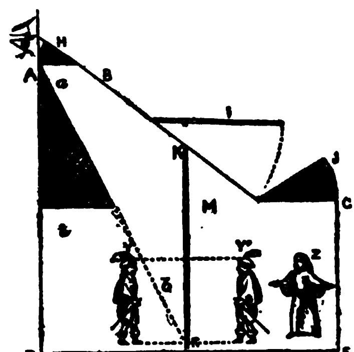
GHOST-MOTH (*Hepialus humuli*), a species of moth very common in many parts of Britain, and of which the caterpillar—popularly known as the OTTER—often commits great ravages in hop plantations, devouring the roots of the hop. It feeds also on the roots of the nettle, burdock, and some other plants. This moth belongs to a family (*Hepialidæ*) often popularly called *Swifts* from their rapid flight, having long narrow wings, and destitute of a tongue. The antennæ are short. The male ghost-moth is entirely of a satiny white color above; the female yellowish with darker markings; both sexes are brown on the under side. They are to be seen flying about in the twilight, generally over lawns and pastures, not unfrequently in churchyards, from which circumstance, and from the white color of the males and their sudden disappearance in the imperfect light, on their folding their wings, or rising above the level of the spectator's eye, so that the brown part is turned towards him, they derive their name. The caterpillar, which is sometimes 2 in. long, is yellowish white, with scattered hairs. It spins a large cylindrical cocoon among the roots on which it has been feeding, and there becomes a chrysalis.

GHOSTS, OPTICAL. Many remarkable exhibitions have been introduced in recent years, based on certain simple laws of optics long known to scientific men. The mysterious phantom appearances have led to the designation of *ghosts;* but nothing necessarily either ghostly or ghastly attaches to the exhibition. No new principle has been discovered; it is nothing more than an ingenious application of mechanism to render visible to a body of spectators certain phenomena of reflection and transmission, by varying the intensity of light passing upon or through large plates of glass, and by adjusting the position of the actors with reference to the glass and to the spectators.

Mr. Dircks, in a paper read before the British association at Leeds in 1858, and afterwards embodied in a volume, said that his attention had long been directed to this matter. In 1838, he devised something which, under the name of a "transparent mirror," he thought likely to be productive of curious optical effects; but he abandoned the subject for nearly 20 years. In 1856, he happened accidentally to see a body so peculiarly placed as to appear to be transparent; and this led him to make a variety of experiments, to combine an object with its shadow or its reflection in such a way as to render their discrimination difficult. He supposed a theater or room, with spectators placed on an elevated and darkened series of seats; and he showed how they might see two illuminated figures on a stage, without knowing that one was a reality and the other a reflection. By following out the idea, he saw how an actor might get behind a plate of glass, and seem to communicate with the shadow or "double" of a second actor—how, in other words a living or solid figure might be so associated with a mere

phantom, that the two could play a sort of a drama together, suddenly terminated, perhaps by one of them fading away, and vanishing through the wall or furniture of the apartment.

Mr. Eircks constructed a small box or model to illustrate the principle; and as it really contains the germ of most of the large subsequent exhibitions, we will describe it. The accompanying diagram shows the vertical section. ABCDE is an oblong box inclosed on all sides, higher at one end than at the other; there are two doors at the sides of the box; H, I, J, are three flapped or hinged openings at the top of the box. H, for the eye of the spectator, I to put in the models or figures, and J to admit light; KK is a transparent vertical plate of glass, forming a partition in the box; L, M are two compartments separated by this partition; N is an opaque screen, to shield a portion of the compartment L from the eye of the spectator. Now, with small figures or models, very curious optical effects can be presented in this box. Place two figures, Y' and Z, in the two compartments, one in each. An eye at A will see the real figure Z, and the reflection Y' of the figure Y, but not Y itself; and both will *appear* to be in the same compartment. By opening, in various degrees, of flap J and the side-doors F and G, or by closing any one of the three, and opening the two others, the admission of light may be so regulated as greatly to modify the effects. In order that Y' may appear real, no solid body should be placed immediately before or behind it, or its transparency would at once be detected. If the apparatus were large enough for living performers, Z would not see Y', although he would see Y; but by a little rehearsal, Z and Y' might appear to act together. If, omitting Z, two figures exactly alike, or two similar globes or cubes, were placed at Y and Y', then Y' would appear to a spectator like a substance and a phantom combined; and, according to the mode of throwing the light more strongly on the one or the other, the substance might seem to dissolve away into the phantom, or the phantom into the substance. By supposing a small theater or large room to be used instead of a box, living performers instead of model figures, and ranges of seats instead of an eye-hole, this apparatus would become a phantom exhibition for many spectators at once.



Vertical Section.

The exhibition of Messrs. Dircks and Pepper, patented in 1863, gave celebrity and popularity to the subject, being shown at the Polytechnic institution, London. The main purpose, as described in the specification, is, "to associate on the same stage living persons and phantoms to act together." There is a stage like that of a theater; and an under-stage at a level 6 ft. or so lower, between it and the spectators. The stage can be seen by all the persons in the hall or theater; but the under-stage (though nearer) is so managed, by means of screens, dimness of light, and dark baize lining, that its existence is scarcely even suspected by most of the spectators. There is a large plate of unsilvered glass, nearly upright, between the under-stage and the stage, so artfully framed and adjusted as to be invisible, and allowing persons on the stage to be seen almost as clearly as if there were no glass there. An actor, whom we will call the hidden actor, is on the under-stage, entirely below the level of the real stage, and out of sight of the spectators. A strong light is thrown upon his face and figure, and is reflected from the front of the glass towards the spectators, who can thus see the reflected image, but not the hidden actor who produces it. For brevity's sake, we will call this reflected image the *phantom*. In order that the reflected light may come in a proper direction to the spectators, the glass is placed either upright or slightly leaning forward at the top, according to the height at which the seats of the spectators are placed. If the light is very strong on the hidden actor, and rather faint on the glass, the phantom appears with wonderful force and vividness. By means of a trap-door closing over the under-stage, the phantom may be made to disappear instantly; or, by varying the intensity of the light, the phantom may seem to dissolve gradually. If the under-stage is too small for this, a small bust or model may take the place of the hidden actor; while, on the other hand, if the under-stage is very large, and all the arrangements planned on a complete scale, there may be a whole group of hidden actors and actresses carrying out the details of some story by being reflected into phantoms all at once, or one or two at a time; they may even dance and sing, making their phantom reflections appear to do the like. In all this, there is no mirror or silvered glass, nor is there any focusing lens. The visible actors on the visible stage may take up such positions as to be near the phantoms, and combine with them to play a dramatic scene. By having a trap in the under-stage, up which a hidden actor may ascend, or one in the proper stage, up which a visible actor may ascend; by arranging the transparent sheet of glass in such a way that it may be varied in inclination, and either raised or lowered; and by throwing light of various colors on the hidden actors, the ghostly effects may be very strikingly diversified.

Most of the subsequent patents relate to extensions of this method, with certain minor additions. Munro's patent (1863) is concerned chiefly with placing between the lamps and the hidden actor screens and media of various kinds, so as to let light fall on some parts, and leave others in darkness. In this way a phantom may be shown as if dismembered, head severed from the body, legs and arms separated, etc. By placing a movable mirror or silvered glass near the hidden actor, and shifting this while the action is going on, the phantom may be made to go up and down and across the transparent glass. By the aid of two or more mirrors, the phantom may be magnified or diminished in size. By other arrangements, the visible actor may seem to enter a solid cube, or may seem to give a bottle or a letter to the phantom—effects due, in fact, to the superposition of a reflected image upon an object seen by transmitted light. Maurice's patent (1865), instead of causing a hidden actor to be reflected as a phantom, makes the visible actor himself become a sort of phantom before the eyes of the spectators. The phantom of a hidden object is superposed upon the real form of the actor by nice adjustment; and then, if the light is dimmed which falls upon the actor, and the light brightened which falls upon the hidden object, the former will appear to fade away into invisibility; or the arrangements may be so managed as to make him seem to go through a solid wall, or to be suspended in the air, or walking, or flying.

Without further describing particular arrangements, we may remark generally, that the most striking effects of these illusions are those which are due to superposition of two pictures or scenes, one reflected *from* the glass screen, and the other seen *through* it. It is easy to see what room there is for the exercise of ingenuity in contriving combinations of effects. The details of dramatic scenes can be enacted by phantoms and real persons combined. Punch and Judy can be made to go through their vagaries and batter each other, one being a real figure, and the other a phantom; and it is not until Punch sinks through the solid floor that the spectator knows which was the phantom.

GHUMURDJI'NA, or KOMULDSI'NA, a t. of European Turkey, in the eyelet of Rumili, is situated on the right bank of the Karadji, about 80 m. s.w. of Adrianople. It has extensive bazaars and a small citadel, and is supposed to contain about 8,000 inhabitants.

GHÛR, or GHORE, a mountainous district of western Afghanistan, lying s.e. from Herât. It was conquered by the famous Sûnní hero, Mahmûd of Ghizni (q.v.), and about three centuries afterwards was overrun by Genghis Khan, who almost completely exterminated the ancient inhabitants. It is celebrated in history as having been the original possession of the princes who established the second Mohammedan dynasty in Hindûstân. It is inhabited at the present day by the independent nomad Tartar tribes of the Hazâreh and Eimâk, principally the latter.

GHÛRI, or SULTANS OF GHÛR, were a race of princes who had the seat of their empire in the country of Ghûr (q.v.), and ruled over Persia, northern Hindûstân, and Transoxiana. The first of this family mentioned in history is Sûri, who opposed an obstinate but unavailing resistance to sultan Mahmûd of Ghizni. One of his descendants named Husseyne was subsequently appointed governor of Ghûr, in which office he was succeeded by his sons. But Behram Shah having put to death one of the brothers, the others threw off their allegiance to the race of Sebekteghin, and hostilities ensued (see GHIZNEVIDES), in which the eldest brother, Seyf-ud-deen, was killed, and his brother Allah-ud-deen, surnamed Jehaun-souz (the conflagrator), succeeded to the sovereignty. After subduing the sultan of Ghizni, Allah-ud-deen invaded Khorassan, but was defeated and taken prisoner by sultan Sunjur the Seljûk, He was succeeded by his son Mahommed in 1160, who was assassinated at the end of the first year of his reign. Gheiatheddin Mahommed ascended the throne in 1161, and after a long and bloody contest with the Khaurezmians, succeeded in obtaining possession of Khorassan. During his reign the affairs of Ghizni were committed in charge to his brother, Shahab-ud-deen Mahommed, who, having subdued the Ghiznevide provinces w. of the Indus, crossed that river and conquered successively the provinces of Mûltan (1176), Lahore (1186), and Ajmere (1190), defeating the rajah of Ajmere's army, numbering 300,000 horse and 3,000 elephants, and in the course of the next six years conquering Hindûstân as far s. as Nagpûr, and westward to the Irrawady. It is from this epoch that the preponderance of Islam in Hindûstân is dated. Shahab-ud-deen succeeded to the throne in 1203, on the death of his brother (see GHIZNEVIDES). The house of Ghûr had now reached its acme of power, their territory extending from the Caspian sea to the bay of Bengal, and from the Jihon to the Indian ocean. Shahab-ud-deen, having invaded Khaurezm in 1204, was attacked by the sultan of that country, and completely routed. In the following year, he undertook an expedition into Kojud, on the s. border of Cashmere, in order to reduce that rebellious province, in which undertaking he obtained complete success, but on his return was assassinated by one of the Fedayan, or followers of Hussun Sabah, in 1206. His nephew, Mahmûd, succeeded; but after a short reign of four years was assassinated. After his death, some members of the family made feeble efforts to revive the grandeur of their ancestors, but as the sultans of Khaurezm had by this time subjugated the whole Persian empire, their attempts were fruitless.

GIANIBE'LLI, or **GIAMBELLI**, FEDERIGO, a famous military engineer, was born at Mantua about the year 1530. After serving for some time in Italy, he proceeded to

Spain and offered his services to Philip II., but having failed to obtain an audience of that monarch, and conceiving, moreover, that he had been personally slighted, he abruptly quitted Madrid, swearing, as the story goes, that the Spaniards would yet hear of him; and after a residence for some time at Antwerp, where he acquired a high reputation as a mechanist, passed over to England and entered the service of queen Elizabeth, who granted him a pension. During the war of independence in the Netherlands, Alexander, duke of Parma, generalissimo of the Spanish forces, besieged Antwerp in 1585, whereupon Elizabeth commissioned Gianibelli to proceed to the assistance of the inhabitants. On his arrival, he found that the Spaniards had built a vast bridge across the Scheldt, interrupting all communication with the sea, by which alone the city could get provisions or help. Setting his wits to work, Gianibelli invented an infernal machine, which he launched against the bridge one stormy night. The effect was frightful. The whole Spanish army was roused by the noise, and the Scheldt was found to be quivering to its lowest depths. The obstructing bridge was blown into the air, and no less than 800 men—among whom were some of the best Spanish officers—were killed. Many Spanish ships also were either burned or sunk. The want of unity, however, among the citizens, ultimately rendered Gianibelli's aid unavailing, and he was obliged to return to England. Here he was employed at the time of the threatened Spanish invasion in fortifying the coast-line, which he did in a very skillful manner. When the armada appeared in the channel, it was Gianibelli who proposed and carried out the plan of sending fire-ships into the midst of the enemy, and in this way greatly contributed to their defeat. After this he disappears from history, and all we know of him is that he died in London.

GIANNO'NE, Pietro, an eminent historian and lawyer, was b. 1676, at Ischitella, a village of Capitanata, in Naples. He early distinguished himself as an able and learned practitioner at the bar of Naples, and soon realized an easy independence, which enabled him to devote his time and energies to his favorite historical researches. In his beautiful villa, adjoining Naples, he labored during the space of 20 years at his greatest historical work, which, in 1723, he published in four volumes, under the title of *Storia Civile del Regno di Napoli.* This valuable and comprehensive work not only treats of the civil history of the kingdom, but also contains learned and critical dissertations on the laws, customs, and administrative vicissitudes of Naples from the most remote times, tracing the successive working of Greek, Roman, and Christian influences on the legislative and social institutions. Some severe strictures on the spirit of worldly aggrandizement, and progressive corruption of the doctrines and practices of primitive Christianity apparent in the modern Roman Catholic church, so enraged the ecclesiastical party, that Giannone was universally denounced and anathematized from pulpit and altar. The ignorant fanaticism of the lower classes was aroused by the grossest calumnies leveled at the great writer, who was finally forced to yield before the tempest and take refuge at Vienna. The history was solemnly condemned as heretical and libelous by the pope, and was strictly prohibited. Giannone was granted a small pension by the emperor Charles VI., under whose dominion Naples then was, and received, in some degree, compensation for his sufferings, in the admiration and sympathy of the enlightened spirits of his own land. In 1734, Giannone was deprived of his pension and returned to Venice, from whence he was expelled, and forced to seek shelter in Geneva. There he composed his famous and bitterest diatribe, entitled *Il Triregno*, against the papal pretensions, and even proclaimed his adoption of the Calvinistic doctrines. Shortly after, an emissary from the court of Turin, having artfully ingratiated himself into the confidence of Giannone, induced him to enter the Sardinian states, where he was immediately arrested and conducted to the fortress of Turin, a close prisoner. Giannone beguiled his tedious confinement with his chosen studies, and retracted his change of religious opinions, a step which in no way alleviated his persecution. He died a prisoner in the fortress, in 1748, after an incarceration of 12 years. His son, Giovanni, was assigned a liberal pension by the new king of Naples, Don Carlos of Bourbon, who thus sought to avert from his house the reproach which overwhelmed the persecutors and jailors of one of Italy's most illustrious citizens. *La Storia Civile* has passed through several editions, the most modern is that of Milan, 1823, in 13 vols., 8vo. See *Corniani; Vita di P. Giannone da Leonardo Panzini; Storia della Letteratura Italiana da Maffei.*

GIANTS' CAUSEWAY (deriving its name from a mythical legend that it was the commencement of a road to be constructed by giants across the channel to Scotland), is a sort of pier or mole, of columnar basalt, projecting from the northern coast of Antrim, Ireland, into the North channel, about 15 m. from Coleraine. It is part of an extensive and overlying mass of basalt, from 300 to 500 ft. in thickness, which covers almost the whole county of Antrim and the eastern part of Londonderry, extending over an area of nearly 1200 sq. miles. The basalt occurs in several beds, interstratified with layers of ash. It covers secondary strata, converting the chalk into granular limestone, and the lias shale into Lydian stone, where it comes in contact with them. Several of the basaltic beds are more or less columnar, but three layers are remarkably so. The first appears at the bold promontory of Fair head; its columns are coarse and large, exceeding 200 ft. in height. The other two are seen together rising above the sea-level at Ben-

gore head. The lower one forms the causeway at the place where it is uncovered, as it again gradually dips under the sea. It is exposed for 800 yards, and exhibits an unequal pavement, formed of the tops of polygonal columns, fitting so compactly that the blade of a knife can scarcely be inserted between them. The columns are chiefly hexagonal, though examples may be found with 5, 7, 8, or 9 sides; and there is a single instance of a triangular prism. The diameter of the pillar is very variable, but the average size is from 15 to 20 inches. Each pillar is divided by joints of unequal length, the concave hollow at the end of one division fitting exactly into the convex projection of the other. The rock is compact and homogeneous, and is somewhat sonorous when struck with a hammer.

The causeway is divided into the little, middle, and large causeways. The large causeway, which is formed by the lowest of the three columnar beds of basalt, is about 30 ft. wide, and runs more than 200 yards from its exposure on the cliff till it is covered by the sea. The little and middle causeways are formed from the second columnar stratum, and are less remarkable than the other.

GIANTS AND DWARFS. A giant (from the Greek word *gigas*) is an individual whose stature and bulk exceed those of his species or race generally.

Until the beginning of the present century, it was universally believed that giants, of a size far exceeding those who are exhibited in our times, formerly existed, either as nations or as individual specimens. This belief was based (1) on the asserted discovery of colossal human bones; (2) on supposed scriptural evidence; and (3) on the evidence of various ancient and medieval authors.

A reference to the first volume of Cuvier's *Ossements Fossiles* will show that the bones of elephants, rhinoceroses, mastodons, etc., have been exhibited and accepted as evidence of pre-historic giants. Even so good a naturalist as Buffon fell into this popular delusion, and figured the bones of an elephant as the remains of human giants. Isidore Geoffroy Saint-Hilaire, in his *Histoire des Anomalies de l'Organisation*, notices several of the most famous of these cases. A gigantic skeleton which was found at Trapani, in Sicily, in the 14th c., was at once pronounced to be that of the classical giant Polyphemus, and his height was calculated at 300 feet. It was pointed out that the bones differed in form as well as in size from those of man, but this objection was easily met by the question: Why, if his height was sixty times as great as that of an ordinary man, should not his form be also different? Many less celebrated giants were subsequently exhumed in Sicily, and the existence of the "Osseous Caverns," described by De Quatrefages in his *Rambles of a Naturalist*, fully accounts for such discoveries, at an epoch when few could recognize the differences in form between the bones of an elephant and those of man. Passing over a giant whose bones were exposed by the action of the Rhone in 1456, and whose height was estimated at 30 ft., and another whose skeleton was discovered near Lucerne in 1577, and who, according to the calculation of the learned physician Plater, did not exceed 19 ft., we come to the case of king Teutobochus, whose remains were discovered near the Rhone in 1613, by a surgeon named Mazurier, whose *Histoire Véritable du Géant Teutobochus* (1618) gave rise to a warm controversy. The anatomist Riolan endeavored to expose the imposture, but the Parisians rushed in crowds to see the mastodon's bones, which were reported to have been found in a tomb 30 ft. long, bearing the inscription "Teutobochus Rex." Nor have our own countrymen been less credulous than their continental neighbors. In 1712, Dr. Mather, in the *Philosophical Transactions*, announced the discovery of enormous bones and teeth which had been found in the state of New York, and which he regarded as affording evidence of the existence of giants of enormous size in ancient times. The bones were in reality those of a mastodon.

The Scripture evidence, when carefully examined, does not amount to much. The Hebrew words *nephilim* and *giborim*, which occur several times in the Book of Genesis, and which are translated *giants*, might as well be translated *bearded*, *cruel*, or *violent men*. The height of Og, king of Bashan, is not given; we are only told the length of his bed; and excluding his helmet, which was probably taken into account in the recorded measurement, Goliath, at most, did not exceed 8¼ ft. in stature, and consequently was not taller than some giants of modern days.

The classical evidence is abundant, but obviously untrustworthy. Thus Plutarch relates that Serbonius had the grave of Antæus, in the city of Tungis, opened, and "finding there his body, full 60 cubits long, was infinitely astonished, ordered the tomb to be closed, gave his confirmation to the story, and added new honors to the memory of the giant." Pliny reports that an earthquake in Crete disclosed the bones of a giant 46 cubits in length, who was held by some to be Orion, and by others Otus. Descending to more certain evidence, there is no doubt that a height of between 8 and 9 ft., and probably of more than 9 ft., has been attained. There is a skeleton in the museum of Trinity college, Dublin, 8 ft. 6 in. in height; that of O'Brien (or Byrne), in the museum of the college of surgeons of England, is 8 ft. 2 in.; and that of a giant in the museum at Bonn is 8 ft.; and the actual body with the soft parts attached was probably 2 or 3 in. longer than the skeleton. (O'Brien, for example, measured 8 ft. 4 in. after death, as we find recorded in the *Annual Register*, vol. xxvi. p. 209.)

We commonly apply the term *dwarf* to any organized being, but especially to indi-

viduals of the human species whose height is much less than the average height of their race. Strictly speaking, however, the word should be restricted to those cases in which there is a general and uniform arrest of growth, except, perhaps, in the nervous system, which is often fully developed in dwarfs.

The ancients believed not only in dwarfs of extreme minuteness, but in nations of them. Aristotle, the greatest naturalist that perhaps ever existed, declared that the report of trustworthy witnesses testifies to the existence of a minute race of men, with minute horses, living in the caves which are washed by the waters of the Nile; and Pliny gives various details regarding their habits and their geographical position. Amongst the extreme cases recorded on ancient authority, we may notice that of Philetas, a poet who was a contemporary with Hippocrates, and who was obliged to balast himself, to avoid being blown away by the wind; that of the Egyptian dwarf mentioned by Nicephorus Calistus, who, at the age of 25 years, did not exceed a partridge in size; and lastly, that of the poet Aristratus, of whom Athenæus records that his stature was so small that *no one could see him.*

We shall now briefly notice a few of the most remarkable dwarfs of modern times. All the readers of *Peveril of the Peak* are acquainted with sir Geoffrey Hudson. Up to the age of 30, his height was only 18 in.; from that age, he rapidly grew to the height of 3 ft. 9 inches. He had an enormous head and large hands, but in other respects was well proportioned. He died at the age of 63. Count Joseph Borowlaski was the son of well-formed healthy parents of the ordinary size, who had 6 children, of whom the first, third, and fifth were dwarfs. Joseph, who wrote a history of his own life, records that his eldest brother was 3 ft. 6 in. high; then came a son who was 5 ft. 10 in.; then came Joseph himself, whose height at 20 was 2 ft. 4 in., and at 30, 3 ft. 3 inches. He was succeeded by three others, the middle one being a girl, who died at 22 of the small pox, being then 2 ft. 2 in., but of admirable proportions. Joseph Borowlaski was very well proportioned, was married to a woman of ordinary size, who brought him several well-formed children, and died at Bank's cottage, near Durham, in 1837, at the age of 98—a great age for an ordinary man, and without example in the history of dwarfs. Nicholas Ferry, commonly known under the name of Bébé, was another celebrated dwarf. His parents and his brothers and sisters were all well-formed persons. He was a 7 months' child, and at birth measured less than 8 in., and weighed less than a pound. When 5 years old, a physician, who examined him, reported that he then weighed 9 lbs. 7 oz., and stood 22 in. high, but was formed like a young man of 20. He died in his 23d year, being then under 3 ft. high. (Humphrey, *On the Human Skeleton*, p. 101.) In the museum of the faculté de médicine of Paris, there is a wax-model which represents him at the age of 18; and in the muséum d'histoire naturelle is his skeleton, which in the complete ossification of the bones, and in the disappearance of the cranial sutures, resembles that of an aged person. According to C. G. Carus (*Symbolik der Menschlichen Gestalt. Zweite Auflage*, 1858, p. 83), gen. Tom Thumb, the well-known dwarf, exhibited some years ago in this country, was 25 in. in height, and weighed 25 lbs.; and prince Colobri, a Slesvig dwarf, who was being exhibited in Dresden in 1851, was of a similar height and weight, his age being 21 years. Carus likewise examined, in the year 1857, a Dutch dwarf, who took the name of Tom Thumb. He was aged 18 at the time of the examination, and then measured about 2 ft. 4 inches. (These are probably Prussian measures, which slightly exceed those of this country.

On comparing the *data* in our possession regarding giants and dwarfs—and for most of these *data* we must refer the reader to Geoffrey Saint-Hilaire's *Histoire des Anomalies*—it appears (1) That giants are of rarer occurrence than dwarfs; (2) That giants are usually of a lymphatic temperament, and of a very delicate complexion, often deformed, and almost always badly proportioned; that their muscles are flabby, and their voice weak; while dwarfs are often perfectly well proportioned, and are strong for their size; (3) That giants are never long-lived—O'Byrne died at 22, Magrath at 20—while dwarfs seem to attain the full ordinary period of human existence—Borowlaski died at 98, Hudson at 63; and although we do not know the age at which Therese Souvray—a dwarf described by Virey—died, we know that at the age of 73 "*elle était encore vive, gaie, bien portant, et dansait à la mode de son pays;*" (4) That while giants usually exhibit a want of activity and energy, and are feeble both in body and in mind, dwarfs are in general lively, active, and irascible (Borowlaski in his memoirs gives a good illustration of the last characteristic, as exhibited by the dwarf Bébé: "When he perceived that the king took pleasure in my society, he conceived the most violent jealousy and hatred of me . . . . and endeavored to push me on to the fire;" and sir Geoffrey Hudson's irascibility is well depicted in *Peveril of the Peak*). That the intellectual power of dwarfs is sometimes considerable, is sufficiently evidenced in the cases of Borowlaski, gen. Tom Thumb, and the Dutch Tom Thumb, who, according to Carus, spoke four languages.

We know little of the causes which occasion the excessive development or the arrested growth on which the production of giants and dwarfs depends. Bishop Berkeley* is said to have attempted with considerable success to manufacture a giant. He

* Our authority for this statement is Geoffrey Saint-Hillaire, who quotes Watkinson's *Philosophical Survey of Ireland* (Lond. 1777). The bishop died in 1753.

took a poor orphan, named Magrath, and reared him on certain hygienic principles (Virey conjectures that he fed him with mucilaginous foods and drinks, but nothing seems known on this point), which were so far successful that, at the age of 16, he was 7 ft. in height, and that at the time of his death, which occurred, with all the symptoms of old age, at the age of 20, he was 7 ft. 8 in. high. If food in this case did really produce a giant, why cannot our farmers be as successful as the bishop? They can only produce fatty monstrosities, not giants.

Geoffrey Saint-Hilaire devotes a special section of his book to "the causes of dwarfism," but he only arrives at the general conclusion, that in these cases there is an obstacle to the proper nutrition and development of the fœtus; that this obstacle may be due either to something wrong in the maternal organism, or more commonly to some disease affecting the fœtus itself; and that this disease is usually rachitis or rickets.

Mythological Giants and Dwarfs.—Giants play a part in the mythology of almost all nations of Aryan descent. The Greeks, who represented them as beings of monstrous size, with hideous countenances, and having the tails of dragons, placed their abode in volcanic districts, whither they were fabled to have been banished after their unsuccessful attempt upon heaven, when the gods, with the assistance of Hercules, imprisoned them under Ætna and other volcanoes. Their reputed origin, like the places of their abode, points to the idea of the mysterious electrical and volcanic convulsions of nature, which they obviously typify; and, in accordance with this view, they are said to have been of mingled heavenly and earthly descent, and to have sprung from the blood that fell from the slain Ouranos upon the earth, Ge, which was their mother. In the cosmogony of the northern nations, giants occupy a far more important place than the Greeks assigned to them, for here the first created being was the giant Ymir, called also "Aurgelmir," or "the ancient Chaos," the progenitor of the frost-giants (Hrimthursar), among whom dwelt the All-Father before the creation of heaven and earth. The mode of origin of Ymir was as follows: In the beginning of time a world existed in the north, called Niflheim, in which was a well, Hvergelmir, from whence issued a poisonous stream which hardened into ice, the accumulation of which formed the northern part of Ginnungagap, or abyss of abysses, whose southern extremity was radiant with the heat and light which emanated from another world, known as "Muspelheim." The meeting of heat and ice produced drops, which, through the agency of the same creative power (the All-Father) which had sent them forth, received life and a human form. This was Ymir, who was nourished from four streams of milk, which flowed from the cow Audhumla, or the nourishing-power, which had been created by Surt, the guardian watch of Muspelheim. While Ymir slept, a man and woman grew from under his left arm, and a son was produced from his feet. In course of time, other beings were generated from the salt and frost-covered stones which the cow Audhumla licked, and from these were born three brothers, Odin, Vili, and Ve, who were gods, and who, having slain Ymir, and dragged him out into the middle of Ginnungagap, formed from his blood the sea and all waters, and from his huge body heaven and earth and all solid things in nature.

With Ymir perished all the frost-giants except Bergelmir, who, with his wife, escaped on a chest or drum, and became the father of the new giant dynasty of the Jötuns. The gods formed, however, of the eyebrows of Ymir, a wall of defense against these giants, who thenceforward dwelt in Jötunheim, beyond the boundaries of the ocean, which encircled Midgard, the future abode of the sons of men. The Æsir or gods lived in their own city, Asgard, occupying themselves with works of industry till they were corrupted by the giantess who came to them from Jötunheim, when the golden age ceased, and discord arose among the gods. At the instigation of the maidens from Jötunheim, the gods created dwarfs and men; the former from the maggots generated within the body of Ymir, and the latter from trees; and from this time the giants gradually lost their power, under the united opposition of gods and men. In the popular belief, common in all countries, that through the agency of giants mountains and islands have arisen, and rocks and mountains have been hurled from their original sites, we trace the ideal personification of the forces of nature, which, after long periods of inert repose, exhibit sudden and uncontrollable outbursts of violence: thus giants were represented as good-humored and complacent when at rest, but implacable, savage, and treacherous when excited; while they were at all times impressed with a consciousness that, notwithstanding their huge bulk, and the excess of heads and arms with which many of them were gifted, they were but stupid monsters, unable to cope with the ready wit and keen intelligence of divine or even human beings, to whom they believed it was the decree of fate that they must ultimately succumb. In this respect, the giants typify the heathen element in its conflict with Christianity, and northern sagas are rife with the histories of gigantic, wild, and cruel races, known as *Thursar* (Goth. *thaursjan*, to thirst, or *Jötnar;* Anglo-Saxon *etan*, to eat), who ate and drank voraciously, and subdued all things to their sway, until there came from the far east a people, who knew and worshiped the god of the universe under the name of the "All-Father," and who, by their greater skill, overcame the savage giants of the north, and compelled them to withdraw more and more into the recesses of the forests and mountains, whence they only emerged from time to time in the form of mountain trolls and giants.

The *dwarfs* who figure in the *Eddas* as cunning and crafty elves, skilled in magic and

in the working of metals, are conjectured to have been a race of Oriental Lapps, who immigrated into Sweden and Norway later than the Finns, who were the descendants of the giants, and therefore the oldest of the races that now occupy the Scandinavian peninsula. When considered under the broadest signification of the term, dwarfs (Goth. *dvairgs*, which Grimm conjectures may be identical with the Greek *theourgos*, one who does supernatural works) typify the transition from inorganic to organic nature, and thus personify the subordinate powers of nature; and under this idea they are represented as assisting men by combining the primary ores into new mineral bodies, and fostering the development of fruits and seeds. Considered from this point of view, they occupy an intermediate position between giants and men; and while they fear both, they incline to serve the latter at the expense of the former, and thus appear under the form of beneficent elves (q.v.), fairies, and brownies (q.v.). During the latter part of the middle ages, when the traditionary folk-lore of western Europe was being supplanted by the literature of the monks, which consisted mainly of legends of saints, the devil and the fallen angels took the place, in the minds of the illiterate, that had hitherto been occupied by giants and dwarfs; and the various supernatural feats of strength which had in earlier ages been ascribed to these imaginary beings, were attributed to Satan and his attendant spirits, or in some cases to the saints of the church.—See Grimm's *Deutsche Mythologie*, Thorpe's *Northern Mythology*, Grundtvig's *Nordens Mythologie*, and Petersen's *Nordisk Mythologie*.

GIAOUR, a Turkish word, corrupted from the Arabic *kiafir* ("unbeliever"), and applied by the Turks to all who reject Mohammedanism, especially to European Christians. Though at first used exclusively as a term of reproach, its signification has been since modified, and now it is frequently employed merely as a distinctive epithet. Sultan Mahmûd II. forbade his subjects to apply the term Giaour to any European.—*Giaour* was the title of a poem written by lord Byron, and published in 1813. Compare with Giaour the word Guebres (q.v.).

GIA'RRE, a t. of Sicily, in the province of Catania, 42 m. s.w.-by-s. from Messina, on the slope of Mt. Etna, and not much more than a mile from the sea. It is a rapidly increasing town. Many of its inhabitants are vine-growers and exporters of wine, the surrounding district being famous for its vineyards and the quality of their produce. Pop. above 18,000. The shipping port of Giarre is Riposto, about a mile distant; pop. 6,530. It is a busy place, and many small craft are built. Giarre has a doubtful claim to be regarded as the ancient *Callipolis*. About 5 m. above the town, on the slope of Mt. Etna, are the remains of the celebrated *Castagno de Cento Cavalli*, supposed to have been the greatest chestnut tree in the world. See CHESTNUT.

GIAVE'NO, a t. of Piedmont, stands on the left bank of the torrent Sangone, 17 m. w.s.w. of Turin. It is surrounded by walls, and possesses a castle, erected in 1369 by the abbot of the monastery St. Michel della Chiusa. In 1003, Urban II., count of Savoy, endowed this abbey with the lands of Giaveno, which, however, owing to the unproductiveness of the soil, were not of great value. The town was formerly a thriving commercial place, with a considerable trade in linen, leather, etc. It still possesses some manufactories of linen, cotton, and silk stuffs, besides tanneries and iron forges. Pop. '71, 9,633.

GIB, ADAM, 1714–88; b. Scotland; the leader of the Antiburgher section of the Scottish secession church; and licensed as a preacher in 1740. In the following year, he was ordained minister of the large secession congregation of Bristol, Edinburgh, being the first in the city inducted into such a charge; and there his powerful intellect and his intensity of character soon secured for him a position of considerable prominence. In 1742, he caused some stir by the publication of an invective entitled *A Warning Against Countenancing the Ministrations of Mr. George Whitefield;* and in 1745, he was almost the only minister of Edinburgh who continued to preach, and to preach against rebellion, while the troops of Charles Edward were in occupation of the town. When in 1747 "the associate synod," by a narrow majority, decided not to give full immediate effect to a judgment which had been passed in the previous year against the lawfulness of the "Burgess oath," Gib led the protesting minority, who forthwith separated from their brethren and formed the Antiburgher synod. It was chiefly under his influence that it was agreed by this ecclesiastical body, at subsequent meetings, to summon to the bar their "Burgher" brethren, and finally to depose and excommunicate them for contumacy. In 1765, he made a vigorous and able reply to the general assembly of the church of Scotland, which had stigmatized the secession as "threatening the peace of the country;" and this apology was further developed in his *Display of the Secession Testimony*, published in 1774. From 1753 (when after protracted litigation, he was compelled to leave the Bristol church) till within a short period of his death, he preached regularly in Nicolson Street church, which is said to have been filled every Sunday with an audience of 2,000 persons. Besides other publications, he wrote a volume of sacred contemplations (1786), to which was appended an *Essay on Liberty and Necessity*, in reply to lord Kames.

GIBBET. See HANGING.

GIBBON, *hylobates*, a genus of apes, or tailless monkeys, natives of the East Indies. They are nearly allied to the orangs and chimpanzees, but are of more slender form, and their arms so long as almost to reach the ground when they are placed in an erect posture; there are also naked callosities on the buttocks. The canine teeth are long. The gibbons are inhabitants of forests, their long arms enabling them to swing themselves from bough to bough, which they do to wonderful distances, and with extreme agility. They cannot, however, move with ease or rapidity on the ground. The conformation of their hinder extremities adds to their difficulty in this, whilst it increases their adaptation to a life among the branches of trees, the soles of their feet being much turned inwards. None of the gibbons are of large size. The COMMON GIBBON, or LAR GIBBON (*H. lar*)—black, with a border of gray hair around the face—is found in some parts of India, and in more eastern regions. The WHITE-HANDED GIBBON (*H. albimana*)—black, the face bordered with gray, and the four hands white—is a native of Sumatra. The ACTIVE GIBBON (*H. agilis*), found in Sumatra, is particularly remarkable for the power which it displays of flinging itself from one tree to another, clearing at once, it is said, a distance of 40 feet. The WOW-WOW (*H. leuciscus*) is a gibbon found in Malacca and the Sunda isles. The HOOLOCK (*H. hoolock*) is a native of the Garrow Hills. The SIAMANG (*H. syndactyla*), a Sumatran species, differs from the rest of the genus in having the first and second fingers of the hinder extremities united to the second joint. All the gibbons are of gentle disposition, and easily domesticated.

GIBBON, EDWARD, the historian of *The Decline and Fall of the Roman Empire*, was b. at Putney, April 27 (O. S.), 1737, and was the first child of Edward Gibbon and of Judith Porten, both of good family, and the only one of seven children that survived infancy. Memoirs of his *Life and Writings* were written by himself, and these, with his letters and other miscellaneous works, were published after his death by his friend lord Sheffield, with whom he had long carried on a most confidential correspondence. Few autobiographies are so interesting as that of Gibbon, and none more veracious. It is a self-portraiture, both in regard to what is said and in regard to the manner in which it is said—his pride, self-complacency, integrity, and contempt for the contemptible, and much beside, being all clearly revealed as proposed by him with "truth, naked, unblushing truth." He reflects: "My name may hereafter be placed among the thousand articles of a Biographia Britannica; and I must be conscious that no one is so well qualified as myself to describe the series of my thoughts and actions." So, in his 52d year, after he had finished his "arduous and successful work," he proceeded to do it. Like most thinkers, his actions were few, and apart from his thoughts and the growth of his mind, quite unimportant. He spent a sickly childhood in occasional lessons and desultory reading and discussion with his mother's sister, a lady of a strong understanding and warm heart, whom he calls "the mother of his mind," and to whose kindness he ascribes not only the bringing out of his intellectual faculties, but the preservation of his life in these critical early years. One of his temporary masters was the Rev. Philip Francis, the translator of Horace. His father, who seems to have been the somewhat impulsive possessor of the wreck of a fortune, had him entered at Magdalen college, Oxford, at the age of 15, when he was very imperfectly prepared for this crisis; his extensive reading and interrupted education having produced "a stock of erudition that might have puzzled a doctor, and a degree of ignorance of which a school-boy would have been ashamed." Here he spent 14 idle months, the chief result of which was, that in his incursions into controversial theology he became a convert to the church of Rome, and found himself shut out from Oxford. He was by his father placed under the care of Mallet the poet, and a deist, but by his philosophy the young enthusiast was "rather scandalized than reclaimed." To effect his cure from popery, he was sent to Lausanne, in Switzerland, to board in the house of M. Pavillard, a Calvinist minister, a poor but sensible and intelligent man, who judiciously suggested books and arguments to his young charge, and had the satisfaction of seeing him reconverted to Protestantism, in witness of which conversion he received the sacrament in the church of Lausanne on Christmas Day, 1754, his belief in popery having lasted not quite 18 months. He lived nearly five years in this house, respecting the minister, and enduring with more or less equanimity the "uncleanly avarice" of his wife; and it was here that he began, and carried out steadily and joyously to an extent that will astonish very hard students, those private studies which, aided by his enormous memory, made him a master of erudition without a superior, and with hardly an equal. Here also he fell in love with Mlle. Susan Curchod, the daughter of a clergyman, a young lady beautiful and learned, who afterwards became the wife of M. Necker, the distinguished French minister and financier. Gibbon's father disapproved of this alliance, and he yielded to his fate. After his return to England and his father's house, he persevered in his studies as best he could.

He finished a little work in French, begun at Lausanne, and published it under the title of *Essais sur l'Etude de la Littérature* in 1761. In the same year he became capt. in the Hampshire militia, in which he continued for two and a half years. Of this part of his career he observes: "The discipline and evolutions of a modern battalion gave me a clearer notion of the phalanx and the legion; and the capt. of the Hampshire grenadiers (the reader may smile) has not been useless to the historian of the Roman

empire." The militia being disbanded, he revisited the continent, and traveled into Italy; and among the benefits of foreign travel, he notes its influence in suggesting the work of his life in these words: "It was at Rome, on Oct. 15, 1764, as I sat musing amidst the ruins of the capitol, while the barefooted friars were singing vespers in the temple of Jupiter, that the idea of writing the decline and fall of the city first started into my mind." His plan, originally circumscribed to the decay of the city, grew by years of reading and reflection and delay, to embrace the empire. During these years his father died, leaving his affairs deranged, and he entered parliament for the borough of Liskeard at the beginning of the struggle with America, "and supporting with many a sincere and silent vote the rights, though not, perhaps, the interest, of the mother-country." He sat eight years, but never had courage to speak; "the great speakers filled him with despair, the bad ones with terror." In 1776, the first volume of *The Decline and Fall* was published, and its success was prodigious. The reputation of the author was established before the religious world had had time to consider and attack the last chapters of the work—the 15th and 16th—in which, while admitting, or, at least, not denying, the "convincing evidence of the doctrine itself, and the ruling providence of its great author," he proceeds to account for the rapid growth of the early Christian church by "secondary" or human causes. Hume, who was then slowly dying, in a highly complimentary letter, told him, in regard to these chapters: "I think you have observed a very prudent temperament; but it was impossible to treat the subject so as not to give grounds of suspicion against you, and you may expect that a clamor will arise." The prophetic criticism was correct; the grounds of the "clamor" being, at the best, only strong suspicions that, in becoming a convert from popery to Protestantism, Gibbon had, like Bayle, gone on "to protest against all sects and systems whatsoever." That he did not like to see the barefooted friars in the temple of Jupiter is clear enough all through the six large and compact volumes of his history. He finished this great work on June 27, 1787, at Lausanne, to which he had retired for quiet and economy after leaving parliament, and holding office under government for a short time. In his *Memoirs*, he tells the hour of his release from his protracted labors—between eleven o'clock and midnight—and records his first emotions of joy on the recovery of his freedom and the sober melancholy that succeeded it, all in a style and in a connection which, with much beside, must be studied in his own pages by those who would know Gibbon in his real greatness, self-complacency, egotism, and contemplative sadness. The lady of lord Sheffield, his close friend, having died, Gibbon left Lausanne for England, to console him; and about six months after his arrival, he died without apprehension or suffering, on Jan. 16, 1794, in St. James's street, London, of an enormous rupture and hydrocele, which, as it gave him no pain, he had allowed to grow neglected without speaking of it to either friend or physician for thirty-two years.

In person, Gibbon became very corpulent, and the small bones of the big-headed, delicate boy were in after years hardly adequate to sustain their load. Vanity was, perhaps, his only frailty. He affected the manners of the fine gentleman of last century to the end, and they adjusted themselves grotesquely to the unwieldly body and the massive mind.

It is not easy to characterize a man of so gigantic and cultivated an intellect in few or many phrases. He was a faithful friend, pleasant and hardly rivaled in conversation, not disliked by any one who came near him. His *Decline and Fall* is probably the greatest achievement of human thought and erudition in the department of history; at least Niebühr gives it this high praise. It is virtually a history of the civilized world for thirteen centuries, during which, paganism was breaking down and Christianity was superseding it; and thus bridges over the chasm between the old world and the new. Its style is marked by the highest power of condensation, and is full of smiting phrases and ponderous antitheses. Byron designates him

The lord of irony, that master-spell.

He himself was not unaware of this part of his genius, and he says he cultivated it by reading the *Provincial Letters* of Pascal every year; which must have become eventually a mere form, for two careful readings sufficed to fix almost any composition indelibly on his impressible and retentive memory. His accuracy in regard to fact has never been successfully impeached, and his industry has never been questioned. The best edition of *The Decline and Fall* is that of Dr. W. Smith (1854–55), containing the notes and corrections of Guizot, Wenck, and Milman. See Morrison's *Gibbon* (1878).

GIBBON, JOHN, b. Penn., 1826; graduated at West Point; served in the Mexican war, on the frontier, and in the war of the rebellion. He was chief of artillery in McDowell's army, and was wounded at Gettysburg. He commanded the 24th army corps, and was actively engaged until Lee's surrender. In 1869 he was placed in command of the 7th infantry.

GIBBONS, ABBY HOPPER, daughter of Isaac Hopper, the prison philanthropist, b. Philadelphia, 1801. She greatly assisted her father in the formation of the woman's prison association and of the "Isaac T. Hopper Home" for discharged prisoners. During the war of the rebellion she rendered valuable service in the union camps and hospitals. Her husband, James G. Gibbons, was a well known abolitionist, and in the

riots of July, 1863, their house in New York was one of the first to be sacked. She has been connected officially with many other benevolent works.

GIBBONS, Charles, b. Del., 1814; a member of the Philadelphia bar, and for some years in the Pennsylvania state senate, over which he presided. He was an active whig and an abolitionist, and one of the founders of the union league, the constitution of which he originated.

GIBBONS, Grinling, an eminent English sculptor and wood carver, of Dutch extraction, was born in London in 1648. On the recommendation of Evelyn, he was, by Charles II., appointed to a place in the board of works, and employed in the ornamental carving of the choir of the chapel at Windsor. His works display great taste and delicacy of finish, and his flowers and foliage have almost the lightness of nature. For the choir of St. Paul's, London, he executed the foliage and festoons, and those in lime-tree which decorate the side-aisles. At Chatsworth, the seat of the duke of Devonshire, at Burleigh; at Southwick, Hampshire; and other mansions of the English nobility, he executed an immense quantity of carved embellishment. At Petworth, he devised the ceiling for a room, which is believed to be his *chef-d'œuvre*. In marble and bronze, he also produced several fine pieces. Among these are the statue of James II., behind the banqueting hall, Whitehall; of Charles I., at Charing Cross; and that of Charles II., at the bank of England. The wooden throne at Canterbury; the monument of Viscount Camden at Exton, Rutlandshire; and the baptismal font at St. James's church, London, are by him. He died Aug. 3, 1721.

GIBBONS, Orlando, an eminent English musician, was b. at Cambridge, in 1583. At the age of 21, he became organist of the chapel royal; and in 1622, on the recommendation of the learned Camden, he received from Oxford university the degree of doctor in music. He was the best church composer, and, according to Anthony Wood, "one of the rarest musicians of his time." His madrigals have always been popular. Of these, three, *Dainty Sweet Bird*, *O that the Learned Poets*, and *The Silver Swan*, are considered far superior to most compositions of the kind. He composed the music for the marriage ceremonial of Charles I., in 1625; but while attending it officially, he caught the small-pox, and died at Whitsunday thereafter. A monument to his memory, erected by his wife over his burial-place in Canterbury cathedral, is still shown. His anthems, *Hosannah to the Son of David! Almighty and Everlasting God!* and *O clap your Hands together!* are reckoned by Wood "master-pieces of the most ingenious and scientific writing in fugue that musical skill ever brought forth." His two brothers, Edward, organist of Bristol, and Ellis, organist of Salisbury, were likewise good musicians. Edward, sworn in a gentleman of the chapel royal, in 1604, was master to the famous composer Matthew Lock. During the civil wars he lent Charles I. £1000, for which he was afterwards deprived of a considerable estate, and, with his three grandchildren, thrust out of his house at a very advanced age. In the *Triumphs of Oriana* are two madrigals by Ellis Gibbons. Gibbons's son, Dr. Christopher Gibbons, at the restoration, was appointed principal organist to the king and to Westminster Abbey, and by a recommendatory letter from Charles II. was created doctor in music by the university of Oxford. Celebrated for his organ playing, he is said to have been the instructor on that instrument of Dr. John Blow, the well-known composer of the pieces published under the title of *Amphion Anglicus*, who died in 1708.

GIBBONS, William, b. Philadelphia, 1781. He studied medicine in the university of Pennsylvania, and settled in Wilmington, Del., where he passed the remainder of his life. He devoted much of his time to the study of the natural sciences, and to philological studies, especially of Hebrew, in which he became a proficient. He was a promoter of the Delaware academy of natural science and first president of that institution. He was a member of the society of Friends, and greatly advocated peace and temperance. He is remembered as the author of a tract, *Truth Vindicated*, which he published during the controversy between the Unitarians and Trinitarians, and which is perhaps the best exposition of the tenets of the Friends ever published.

GIBBS, Alfred, b. New York, 1825; graduated at West Point; and was engaged in the Mexican war. During the war of the rebellion he served in Grant's campaign against Richmond and in other fields. His last active service was on the Indian frontier.

GIBBOS'ITY, (Lat. *gibbus*, Gr. *hūbos*, *kuphos*, humpbacked), a state of disease characterized by protuberance of a part of the body; chiefly applied to humpback or other distortions depending on disease (Rickets, q.v.) of the spinal column.

GIB'BOUS, a term signifying "protuberant," "swelling out," applied to bodies which are double-convex, and particularly to the moon, when she is within a week of the full.

GIBBS, Josiah Willard, ll.d., 1790–1861; b. Mass.; graduated at Yale, and was a tutor there in 1812. In 1824, he was professor of sacred literature, an appointment which he held for the remainder of his life. Among his publications are a translation of Storr's *Essay on the Historical Sense of the New Testament*, a translation of Gesenius's *Hebrew Lexicon of the Old Testament*, *Manual Hebrew and English Lexicon*, etc. He was a contributor to Fowler's work on the English language, to Webster's revised dictionary, and to many scientific periodicals.

GIBBS, Wolcott, ll.d., b. New York, 1822; graduated at Columbia college. He devoted much attention to the study of chemistry and medicine not only in America, but also in Europe. Upon his return from Europe he was chosen professor of chemistry and physics in the New York Free Academy. In 1863, he became professor at Harvard, and lectured on science as applied to useful arts. During the war of the rebellion he was an active member of the sanitary commission, and in 1873, proceeded, as one of the commissioners, to the Vienna exposition. He is the author of many papers on chemical science in the *American Journal of Science*.

GI'BEAH, a Hebrew word signifying a "hill," and giving name to several towns and places in ancient Palestine. The only one requiring special mention is *Gibeah-of-Benjamin*, a small city about 4 m. n. of Jerusalem. It was the scene of the horrible story of the Levite and his concubine, related in the 19th chapter of Judges, and subsequently the residence, if not the birthplace of king Saul. Gibeah-of-Benjamin has been identified with the modern village of *Tuleil el-Fûl*.

GIBEL (*Cyprinus gibelio*), a fish of the same genus with the carp, but of the division of the genus destitute of barbules at the mouth, by which it is easily distinguished from the carp, whilst from the crucian it is at once distinguished by its forked tail. The weight is seldom much more than half a pound, although specimens have been caught of two pounds weight. The gibel is common in some parts of continental Europe; it is supposed to have been introduced into England from Germany, but is now fully naturalized in ponds near London and in many other parts of the country. It is generally known in England as the Prussian carp. It is a good fish for the table, but affords little sport to the angler, seldom taking any bait readily. It feeds partly on aquatic plants, partly on worms and mollusks. It is very tenacious of life out of the water, and and has been known to recover after thirty hours.

GIBELLI'NA, a village of Sicily, in the province of Trapani, and 34 m. s.e. of the town of that name, is situated amid mountains, has a castle and a pop. of about 5,000.

GI'BEON (Heb. signifies "belonging to a hill"), a celebrated city of ancient Palestine, about 5 m. n.w. of Jerusalem. At the conquest of Canaan by the Israelites under Joshua, it was inhabited by the Hivites. By a clever stratagem, the Gibeonites insured the alliance and protection of the invaders, and so escaped the fate of Jericho and Ai; but their deceit being afterwards found out, they were reduced to a condition of servitude, being appointed "hewers of wood and drawers of water unto all the congregation." When the five kings of the Amorites besieged Gibeon, on the ground of its having entered into a traitorous compact with the common enemy of all the Canaanites, Joshua hastened to its help, and overthrew the besiegers with great slaughter. The battle was attended, we are informed, with supernatural phenomena—viz., the standing still of the sun upon Gibeon, and of the moon in the valley of Ajalon; but as the passage where this occurs (Joshua x. 13) is immediately followed by these words: "Is not this written in the book of Jasher?" it has been thought that it may perhaps be only an extract from that collection of national songs; and the fact of its forming two hemistichs, while the rest of the narrative is in prose, certainly does not weaken the probability of this theory. If such a supposition be adopted, the necessity for accepting the statement literally is done away with, and the supposed miracle is resolved into a hyperbole of oriental poetry. The city of Gibeon is mentioned various times in the history of David and his captains; but its sanctity, in the eyes of the Jews, arose from the circumstance of it—or the hill near it—having been for a time the seat of the tabernacle of the congregation, and the brazen altar of burnt-offering. It was at the horns of this altar that the ruthless Joab was slain by Benaiah, the son of Jehoiada; and here Solomon, in the beginning of his reign, with magnificent ceremony sacrificed a thousand burnt-offerings.

GIBRAL'TAR, a rocky promontory, 3 m. in length and ¾ m. in average breadth, forms the southern extremity of Spain. It is situated at the extremity of a low peninsula, which connects it on the n. with Andalusia; its most southern headland, point Europa, is in lat. 36° 2' 30" n., and long. 5° 15' 12" west. Five and a half miles distant across the sea is the Spanish town of Algesiras, between which and Gibraltar lies the bay of Gibraltar, called also the bay of Algesiras.. On the e. side of this bay is the town of Gibraltar, inhabited by a motley agglomeration of English, Spaniards, Jews, and Moors. Pop. '71, 16,454, exclusive of the garrison.

The strip of peninsula connecting Gibraltar with the Spanish territory is called the "neutral ground." It is so low, that, seen from the sea but a few miles off, Gibraltar has the appearance of a detached rock. The approaches both from this neutral ground and from the sea are guarded by a great number of very powerful batteries, and by fortifications so strong in themselves and in their relative bearing on each other, that the rock may fairly be regarded as impregnable so long as a sufficient garrison remains for its defense, and sufficient provision for the maintenance of the troops and any civil inhabitants suffered to reside there during hostilities. The rock is composed of gray primary marble, deposited in strata from 20 to 40 ft. thick. The surface, near the sea, is sandy and red in appearance; higher up, the rock is covered only with short and scanty grass or moss. Seen from the sea, its aspect is uninviting, the whole appearing denuded of trees and verdure: nevertheless, there are grassy, wooded glens in the nooks of the

mountain. In the crevices of the rock grow asparagus, capers, palmitas, aloes, and cacti, while the fauna disporting on the wild, rarely-trodden upper portions, comprises rabbits, partridges, pigeons, woodcocks, and fawn-colored Barbary apes. For various military reasons, shooting is discouraged, and these animals therefore enjoy the utmost impunity. The rock, at its highest point, the Sugar Loaf, attains an elevation of 1439 ft. above the sea. It is perforated by numerous caverns, the largest of which, called the "Halls of St. Michael," have an entrance about 1000 ft. above the sea. Thence there is a descent through a succession of caves—some ample chambers, others mere passages, through which it is barely possible to creep—to a depth of 500 ft. below the entrance; at this point foul air has barred further ingress; but the roaring of the sea has been distinctly heard, which leads to the inference that these gloomy hollows have communication with the waves beneath. Large stalactites are found in most of the caverns, and interesting fossils abound throughout the peninsula.

The climate of Gibraltar is, as a rule, healthy, although the period from July to Nov., when the greatest heat prevails, is attended with some risk to Englishmen; there is, however, a remarkable exception in the case of infants at the period of teeth-cutting, to whom the atmosphere of the place is peculiarly fatal. Of late years, the energetic measures adopted by the engineer officers to improve the drainage of the town have, coupled with stringent police regulations, greatly diminished the death-rate; and Gibraltar is as remarkable now for its cleanly appearance as, up to 1814, it was celebrated for being one of the dirtiest towns in Europe. The place is, however, subject to a periodical visitation, once in twelve years, or thereabout, called the Gibraltar fever, an epidemic which works sad havoc among the troops.

There are no springs of fresh water on the rock, and the inhabitants are therefore compelled to depend on the rain-fall. In consequence of this, every precaution is adopted to preserve as much of the water as possible; tanks are fed systematically by the drops collected from private roofs, and conduits are made to guide the drainage from the rock surface into great public reservoirs. Among the latter, the navy tank, for the supply of ships coming to the port, is conspicuous, its capacity being from 9,000 to 11,000 tons of water. Large stores of grain are maintained in case of siege; but the peninsula does not produce sufficient food to furnish current sustenance for its population. Provisions in plenty can, however, be procured at a cheap rate from the opposite African shore.

The bay of Algesiras or Gibraltar, is about 8 m. long by 5 broad, with a depth in the center of upwards of 100 fathoms. The anchorage, however, is not very good, and the bay is quite exposed, especially to the s.w. winds, which sometimes drag the ships from their anchors and drive them ashore.

Gibraltar has been known in history from a very early period. The Phœnician navigators called it *Alube*, which the Greeks corrupted into *Calpe*, its classical name. With Abyla (now Ceuta) opposite, it formed the Pillars of Hercules, long held to be the western boundary of the world. It is impossible to doubt that such leaders as Hannibal and his fellow Carthaginians must have been awake to the importance of this rock in their expeditions from Africa into Spain; but we have no certain information of its natural strength being made available for defensive or aggressive purposes until the year 711 A.D., when the Saracens, passing into Spain, under Tarik Ibn-Zeyad, a general of the Caliph Al Walid, for the conquest of the Visigothic kingdom, fortified it, as a base of operations and a ready point of access from the Barbary coast. From this chieftain it took the name of Gebel-Tarik, or Hill of Tarik, of which Gibraltar is a corruption. One of the old towers of this early castle still remains. Subsequently, Gibraltar shared in the revolutions among the Moors of Spain, being now in the hands of Almoravide princes from Africa, and again in the power of native Arab monarchs. In 1309, after a gallant defense, it succumbed to the Christians of Castile under Don Antonio de Guzman. The king of Castile immediately constructed additional works and a dock-yard at the "Old Mole," and also took measures to induce a Christian population to settle in the town. The Moors besieged Gibraltar in 1315 ineffectually, but in 1333 it fell to the army of the king of Fez, whom a siege by the Castilian monarch failed to dislodge. In 1436, the Spaniards tried once more to take the stronghold; but they were unsuccessful, until, in a subsequent siege in 1462, the place was captured through the treachery of a renegade Moor. From this time the Moorish power was too thoroughly broken for any serious attempt to be made for the recovery of Gibraltar, which remained in the hands of the Spanish, and was so strengthened by additional fortifications, that the engineers of the 17th c. accounted it impregnable. A combined Dutch and English force, however, under sir George Rooke and the prince of Hesse Darmstadt, demonstrated that Gibraltar could be taken; for in 1704, after a vigorous bombardment, and a landing in force, the governor deemed it wise to capitulate. How great, even then, were the capabilities of the rock for defense is seen from the fact that the garrison, only 150 strong, placed 276 of the English *hors-de-combat* before they surrendered.

Since 1704, Gibraltar has remained continuously in the possession of the British, but not without the necessity of their resisting many desperate efforts on the part of Spain and France to dislodge them. Before the victors had been able to add to the defenses, their mettle was severely tried by a siege in 1704–05. In 1720, it was threatened, and in 1727, actually attacked by an overwhelming force under the count de las Torres.

During this siege, the place was near falling into the hands of the assailants. The most memorable, however, of the sieges to which Gibraltar has been exposed, commenced in 1779, when Britain, being engaged in the struggle with its revolted colonies, and at the same time at war with France, Spain took the opportunity of joining the coalition, and directed her whole strength against the isolated garrison of this small but redoubtable fortress.

The communications with Spain were closed on June 21, 1779, and a strict blockade established by the Spanish fleet; the strength of the besieged force being at this period 5,382 men, including 1095 Hanoverians, under gen. Eliott, the governor. Famine speedily set in; the enemy pushed forward his works for the future bombardment, and commenced active annoyance on Jan. 12, 1780, by firing several shots into the town. Five days later, admiral Rodney overcame the Spanish admiral, threw a good supply of provisions into the fortress, added 1000 men to the garrison, and, removing all useless mouths, left it dependent on its own strength. During 1780, little of importance happened; scurvy disabled many of the defenders; the besiegers advanced their works, continually increased their force, and by obtaining possession of the opposite African ports, cut off the last chance of provisions being obtained for the stronghold.

In April, 1781, starvation stared the British in the face, when, on the 12th, admiral Darby convoyed 100 merchant-vessels into the bay. The Spaniards instantly opened their fire, hoping to reduce the debilitated garrison before effectual aid was received. 114 pieces of artillery, including 50 13-inch mortars, poured their deadly missiles into the place; for many days this bombardment lasted with unabated vigor, and, though less incessant, it continued without intermission until Nov. 26, when, in a desperate midnight sally, the British succeeded in destroying the more advanced of the enemy's lines, in setting fire to many of his batteries, and in blowing up his principal depot of ammunition. This daring enterprise, successfully carried out against lines mounting 135 guns, was attended with surprisingly small loss, and forms one of the most brilliant incidents in a magnificent defense.

After this repulse, the Spaniards ceased severe hostilities for several days, up to which cessation the garrison had been incessantly bombarded for nearly eight months, and had had 568 officers and men placed *hors-de-combat*. The siege continued, however, throughout the winter and spring of 1782 without any remarkable incident. In July, the Duc de Crillon took command of the assailants, and preparations were made for the grand assault. Additional batteries were constructed on the land side, and floating batteries built for this special siege, to batter the fortress from the sea. The latter consisted of ten large vessels, whose sides were fortified by 7 ft. of timber and other materials supposed to be obstructive of shot; they were covered by slanting shot-proof roofs, and were intended to be moored by massive chains within half range of the rocks. Covered boats destined to disembark 40,000 troops, were at the same time prepared. The effective force with which gen. Eliott had to withstand these efforts comprised, with the marine brigade, about 7,000 men.

The great attack commenced on Sept. 8, by a bombardment simultaneously on all sides; 9 line-of-battle ships poured in their broadsides; 15 gun and mortar boats approached the town; while, from the Spanish lines, 170 pieces of ordnance of large caliber opened in one magnificent discharge. This terrific fire continued till the 12th; when the combined French and Spanish fleets, numbering 47 sail of the line, the 10 battering ships mentioned above, esteemed indestructible, with many frigates and smaller vessels, anchored in the bay of Algesiras. On the 13th, every gun of besiegers and besieged was in play. The battering vessels proved, as anticipated, invulnerable to shot and shell. At noon the enemy depressed their guns and did much damage; and the defenders then resorted to the expedient of red-hot balls. These, with carcasses, and incendiary shells, were concentrated on the battering ships in unceasing volleys. Success was doubtful for some hours, but towards evening the gigantic efforts of the British force began to produce fruit. The ship of the Spanish admiral was in flames, the second in command was soon no better off, and although by eight o'clock the attacking squadron was completely silenced, the fire of red-hot shot was continued without intermission till morning. By 4 A.M. on the 14th, eight of the battering ships were on fire. In short, of the ten invincible batteries, every one was finally burned; the Spaniards lost at least 2,000 in killed alone; and the naval attack was completely repulsed with a loss to the heroic garrison of only 16 killed and 68 wounded. It is worthy of record, that notwithstanding the fury to which the British soldiers were wrought, brigadier Curtis, with a devoted band, made gallant and successful efforts to preserve the poor fellows who were left by their affrighted comrades to perish in the burning hulks.

The great bombardment of Sept. 13, 1782, was the crowning triumph of the siege; but the firing continued in a harassing degree from the Spanish lines, until Feb. 2, 1783, when the Duc de Crillon, as much to his own as to gen. Eliott's satisfaction, announced the conclusion of peace. The Spaniards welcomed their late enemies with the enthusiasm due to heroes. The thanks of parliament were cordially awarded to the gallant band; while brave gen. Eliott received the decoration of the Bath, and subsequently the title of lord Heathfield. More space has been allowed to the description of this memorable struggle than we can ordinarily spare to specific wars; but the glorious place it occupies in British annals, the length to which it extended (3 years, 7 months, and 12

days), the disparity of force, the brilliant defense, and the comparatively small loss of the garrison—333 killed, 536 died of disease, 1008 wounded, and 43 deserted—seem to point to this, the last siege of Gibraltar, as an exploit not to be passed over by a mere reference.

Since 1783, the British possesssion of Gibraltar has been unmolested, and few events have happened of any interest, apart from the general history of the empire. At present, England guards this formidable rock with jealous care; every available point for defense bristles with artillery; the mountain is honey-combed with galleries and bomb-proofs, steep escarps bar all approach, and batteries hewn in the solid stone, frown alike on friend and foe. Immense stores of provision, water, and munitions of war are constantly maintained; and the whole is garrisoned by a thoroughly efficient force of about 5,000 infantry, with 1000 artillery, and a smaller body of engineers. The jealousy for its safety would appear to rest rather on making its preservation to the crown of England a point of honor than a matter of national importance; for beyond being a standing menace to Spain, and a source of constant irritation, it is difficult to see its actual use to Great Britain. The harbor is not of great value, and the fortress by no means commands the strait.

With regard to the internal organization of Gibraltar, the law of England prevails; the governor's decision being final in civil cases not involving more than £300. In more important causes, an appeal lies to the British privy council. There is a good police force, under a police magistrate, and tolerable order usually prevails. All religions enjoy a perfect toleration: the Catholics are most numerous, having a bishop and a cathedral; next the Jews, who possess four synagogues; the Protestants, though less numerous, have also a bishop. There are three good public libraries; the best and oldest being that started by the famous col. Drinkwater, the historian of the great siege.

Gibraltar is a free port, and a resort, in consequence, of Spanish smugglers, who drive an amazing trade by introducing contraband goods into Spain. The British government is not altogether free from a charge of breach of faith, in the toleration it has given to these dishonest men: for it is bound by many engagements to use its best exertions to prevent any fraud on the Spanish revenues, in consequence of its possession of this peninsula. The colony of Gibraltar was for many years a most costly one, but of late, by judicious management, it has been made to defray the expenses of its civil government; the heavy charge for the military force being, of course, payable out of imperial funds. In 1872, the revenue amounted to £42,144, and was derived from customs, port and quarantine dues, land revenues, stamps, and licenses. The expenditure for the same year was £42,289. Improvements in the works and gunnery occasionally create heavy expenses.

The town of Gibraltar consists of three parallel streets, in which the curious intermingling of English architecture with the Spanish houses spoils the effect of the whole. English domestic building is eminently unsuited for a climate light and hot, like Gibraltar. There are, nevertheless, some handsome structures.

GIBRALTAR, Straits of (anciently the *Straits of Hercules*), extend from cape Spartel to cape Ceuta on the African coast, and from cape Trafalgar to Europa point on the coast of Spain. The straits narrow toward the east, their width between Europa point and cape Ceuta being only 15 miles, while at the western extremity it is 24 miles. The length (from east to west) is about 36 miles. The tide at Tarifa rises from 7 to 8 feet. Through these straits a continual current runs from the Atlantic, and is so strong that sailing vessels bound westward can pass only by the aid of a brisk wind from the Levant. It is supposed that the waters of the Mediterranean find an outlet here by an undercurrent, as well as by the currents which flow westward along the European and African shores respectively.

GIBSON, a co. in s.w. Indiana, on the Illinois border, bounded by the White and Wabash rivers, and intersected by the Evansville and Crawfordsville railroad, and Wabash and Erie canal; 460 sq.m. pop. '70, 17,371. The surface is undulating and the soil fertile, producing wheat, corn, tobacco, butter, etc. There are also mines of coal. Co. seat, Princeton.

GIBSON, a co. in w. Tennessee on Ohio and Forked Deer river, traversed by the Mobile and Ohio, the Memphis and Louisville, and the New Orleans, St. Louis and Chicago railroads; 600 sq.m.; pop. '70, 25,666—6,856 colored. The surface is nearly level and largely covered with forests. The chief productions are wheat, corn, cotton, and butter. Co. seat, Trenton.

GIBSON, Edmund, d.d., 1669–1748, bishop of London. He was in 1686 entered as scholar at Queen's college Oxford, where, at the early age of twenty-two, he distinguished himself by the publication of a valuable edition of the *Saxon Chronicle* with a Latin translation, indices, and notes. This was followed in 1693 by an annotated edition of the *De Institutione Oratoria* of Quintilian, and in 1694 by a translation in two volumes folio, of Camden's *Britannia*, "with additions and improvements," in the preparation of which he had been largely assisted by the volunteered aid of various English antiquaries. Shortly after Tenison's elevation to the see of Canterbury, in 1694, Gibson was appointed chaplain and librarian to the archbishop, and at a somewhat later

period he became rector of Lambeth and arch-deacon of Surrey. In the discussions which arose during the reigns of William and Anne relative to the rights and privileges of the Convocation, Gibson took a very active part, and in a series of pamphlets warmly advocated the right of the archbishop to continue or prorogue that assembly. The controversy suggested to him the idea of those researches which resulted in the *Codex Juris Ecclesiastici Anglicani,*—a work which discusses more learnedly and comprehensively than any other the legal rights and duties of the English clergy, and the constitution, canons, and articles of the English church. In 1715, Gibson was presented to the see of Lincoln, whence he was in 1723 translated to that of London, where for twenty-five years he exercised an immense influence, being the authority chiefly consulted by the court on all ecclesiastical affairs. Among the literary efforts of his later years the principal were a series of *Pastoral Letters*, and the *Preservative against Popery*, a compilation of numerous controversial writings of eminent Church of England divines, dating chiefly from the period of James II.

GIBSON, JOHN, one of the first sculptors of his day, was b. at Conway, in North Wales, in 1791. His father, a landscape-gardener, removed to Liverpool about the beginning of this century, and here Gibson received his education. His love of art manifested itself strongly, even while he was a mere boy at school, and at the age of 16 he entered the marble works of the Messrs. Francis, by whom he was introduced to Roscoe, whose art treasures were placed at his service. Through the kindness of some wealthy friends he was enabled, in his 26th year, to proceed to Rome, where he became a pupil of Canova, and after his death of Thorwaldsen. Gibson then fixed his residence in that city, and very seldom revisited his native country. His first reappearance in England was after a lapse of 28 years. At first, Gibson showed himself, naturally enough, a faithful follower of Canova, whose graceful softness he made his own. But he did not stop there. By the study of the antique, which Thorwaldsen was the very man to stimulate, Gibson finally rose to ideal purity, and a thorough realization of the grace of form. This advance is clearly traceable in his works. His first important work was a "Nymph Unfastening her Sandal." This was followed by a group representing "Psyche Borne by the Zephyrs," which he executed for sir George Beaumont, and which he several times repeated. In the church of St. Nicholas, in Liverpool, there is a bas-relief of Gibson's representing a traveler conducted on the dangerous path of life by his guardian angel. Among his greatest works are his "Aurora Rising from the Waves to Announce the Day" (belonging to lord Townshend); "The Wounded Amazon" (the property of the marquis of Westminister); "The Hunter and his Dog;" "Narcissus," "Helen," "Sappho," "Proserpine," and "Venus." A spirit of the finest poetry breathes through these works: they are thoroughly classical, and are marked by a noble severity. His grand innovation, viz., that of tinting his figures, which he defended by a reference to Grecian precedents, has not commended itself to the public taste. Among his portrait-statues, those of Huskisson, Peel, George Stephenson, and queen Victoria are the best. In 1836, Gibson was elected a member of the royal academy, to which he left a representative collection of his works. He d. Jan. 1866. See *Life* by lady Eastlake (1869).

GIBSON, THOMAS MILNER, the Right Hon., politician and statesman, only son of maj. Milner-Gibson, was b. at Trinidad, 1807, and educated at Trinity college, Cambridge, where he took a wrangler's degree in 1830. He entered parliament as M.P. for Ipswich in 1837, on the Conservative interest. As his political views expanded, he threw off his allegiance to sir Robert Peel, for which he paid the penalty of the loss of his seat in 1839. In this year he assumed the name of Milner, by royal licence. His eloquence, ability, and superiority to party ties having gained for him the confidence of the Liberals, in 1841 he successfully contested Manchester against the Conservative candidate, sir G. Murray. He had previously distinguished himself by his advocacy of free-trade; and during the succeeding five years, occupied a prominent position, both in and out of parliament, among the orators of the league. When the measure for the repeal of the corn laws was carried, and the Whigs came into office in July, 1846, he was made a privy councilor, and vice-president of the board of trade; but, in April, 1848, gave up a post which was by no means commensurate with his powers and pretensions. More and more identifying himself with the opinions held by Messrs. Cobden and Bright, when the war with Russia broke out, he espoused the unpopular doctrines held by what was called the "Manchester school," or as it was otherwise designated, the "peace party." In 1857, the Whigs and Conservatives of Manchester successfully united to unseat him and his colleague, Mr. Bright. Milner-Gibson was, however, returned at the end of 1857 for the borough of Ashton-under-Lyne, which he represented till Dec., 1868. In 1858, he moved an amendment to the second reading of the conspiracy bill, expressing the abhorence of the house at the attempt by Orsini upon the life of Napoleon III., and its readiness to amend defects in the criminal law; but censuring the government for not replying to count Persigny's dispatch of Jan. 20, 1858. The amendment was carried and the government of lord Palmerston was shattered to pieces. When that noble lord again took office next year, he recognized the skillful parliamentary tactics and influence of Milner-Gibson by offering him a place in his cabinet. He became *ad-interim* president of the poor-law commission in June, 1859, and president of the board

of trade next month. The duties of this office he efficiently discharged till 1866. Milner-Gibson will be honorably and gratefully remembered for his strenuous advocacy of the abolition of the taxes on knowledge. He was for twelve years president of the association for the repeal of these taxes. His labors were crowned with success, first by the repeal of the advertisement duty in 1853, and, secondly, by the repeal of the compulsory stamp on newspapers in 1855. There then only remained the paper duty. Milner-Gibson had made several attempts in previous sessions to induce successive chancellors of the exchequer to abolish this impost; and in 1858, he carried a resolution, "that the maintenance of the excise of paper, as a permanent source of revenue, would be impolitic." Mr. Disraeli, then chancellor of the exchequer, consented to accept this motion, but held himself at liberty, with his party, to oppose the paper duty abolition bill proposed by the government, of which Milner-Gibson was a member, in 1860. The bill was thrown out by the house of lords on financial grounds, but was, next session, incorporated into the general financial scheme of the year; and on Oct. 1, 1861, the paper duty ceased to exist. Milner-Gibson received at a public banquet in London, in the early part of 1862, a valuable and gratifying commemorative presentation of plate from the members and friends of the association for the repeal of the taxes on knowledge. Since his defeat at Ashton-under-Lyne, in 1868, he has taken no prominent part in public life.

GIBSON, WILLIAM, LL.D., 1784-1868; b. Maryland; educated in medicine in the university of Edinburgh; was a pupil of sir Charles Bell. He accompanied the English troops to Spain and was present at the battle of Corunna, 1809. He received a wound at Waterloo. He was the intimate friend of sir Astley Cooper, and occupied the chair of surgery in Philadelphia for thirty-six years. He was the author of a *System of Surgery* and publisher of several lectures, and a volume of travels.

GIDDINESS. See VERTIGO.

GIDDINGS, JOSHUA REED, an American statesman, b. at Athens, Pa., Oct. 6, 1795; d. in Montreal, May 27, 1864. While he was yet an infant his parents removed to Canandaigua, N. Y., where they remained until he was 10 years old, when they went to Ashtabula co., Ohio, among the first emigrants to that region. As the age of 17 years he enlisted as a soldier in the war of 1812, joining the expedition sent to the peninsula n. of Sandusky bay, where he took part in several bloody conflicts with the Indians. After the war was over, he taught school for a time, and in 1817 began to fit himself for the bar, to which he was admitted in 1820. He entered upon the practice of his profession at Jefferson, the capitol of Ashtabula co., where he met with great success. In 1826 he represented the county in the state legislature. In 1839 he was elected to congress as the successor of Elisha Whittlesey. The country was then deeply agitated upon the subject of slavery, and Mr. Giddings at once became the advocate of the abolition of the system in the District of Columbia and the territories under the national jurisdiction, admitting at the same time that congress had no power to abolish it in the states. He seized upon every opportunity to agitate the subject and to aid in the formation of a public sentiment hostile to the system and to its further extension. He supported John Quincy Adams, at that time a member of congress, in his efforts to maintain the right of the people to petition that body upon the subject of slavery and to have their petitions respectfully considered. In his course upon questions relating to slavery he exhibited great boldness and a most indomitable spirit of perseverance, keeping congress in a constant state of excitement. Feb. 9, 1841, he delivered a powerful speech upon the Indian war in Florida, insisting that it was waged in the interest of slavery. Not long afterwards the ship *Creole*, while on her way from Norfolk to New Orleans with a cargo of slaves, was seized by them and taken to Nassau, a British port, where their right to liberty was recognized by the authorities. The advocates of slavery held that the slaves were mutineers or pirates, and that it was the duty of the British government to surrender them to the United States. While the excitement caused by the event was at its height, Mr. Giddings introduced in the house of representatives a series of resolutions declaring that the slaves, having simply asserted their indefeasible right to liberty, were guilty of no crime, and that the British authorities at Nassau had done right in permitting them to go free. The domestic traffic in slaves, the resolutions declared, was no less piratical in character than the foreign, and any attempt to reënslave the men of the *Creole* would be a violation of the constitution and incompatible with the national honor. The resolutions created a tumultuous excitement, and Mr. Giddings was censured by vote of the house for presenting them. He thereupon resigned his seat, but was re-elected by a very large majority. He was kept at his post by successive re-elections until 1859, thus completing a continuous service of 20 years. Until 1848 he was a member of the Whig party, supporting its principal measures, but maintaining his independence in all matters relating to slavery. He did much to develop those views of slavery in its relations to the national government which afterwards became the basis of the republican party. He took a prominent part in the struggle to prevent the extension of slavery to the territory wrested from Mexico by the war of 1846, and in resisting the adoption of the compromises of 1850, especially the fugitive slave law. He was also conspicuous in the debates which preceded the repeal of the Missouri compromise, and in the great struggle by which Kansas was made a free state.

His life was often threatened, twice he was assaulted upon the floor of the house by armed men, and on one occasion set upon by a mob in the streets of Washington. On the 8th of May, 1856, while addressing the house, he suddenly fell to the floor in a state of unconsciousness. He soon revived, but his former strength was never fully restored. On Jan. 17, 1858, he fell again in the same way, and for a time was supposed to be dead. He again rallied, however, but was compelled for a time to leave his post. His disease was an affection of the nervous system, involving the heart. In 1861 he was appointed consul-general for the British North American provinces, with head-quarters in Montreal. He was a man of deep religious convictions, a forcible speaker, and an able writer. In 1843 he wrote a series of political essays signed "Pacificus," which attracted wide attention. A volume of his speeches was published in 1853. He also wrote *The Exiles of Florida*, and *The Rebellion, its Authors and Causes*.

GI'DEON (Heb. signifies "a hewer" or "cutter down," i.e., "a brave soldier") was the name of the greatest of all the judges of Israel. He was the youngest son of Joash the Abiezrite, and lived with his father at Ophrah, in Manasseh. The period in which his youth was cast was a gloomy one for Israel. The people had fallen into idolatry, and as a punishment "the Lord had delivered them into the hand of Midian." It does not appear that the Midianites exercised their supremacy by any actual form of government. Being chiefly wandering herdsmen, like the Bedouin Arabs of the present day, they were rather in the habit of regularly coming up from the desert "to destroy the increase of the earth." So terrible were their marauding expeditions, that it is said they "left no sustenance for Israel, neither sheep, nor ox, nor ass." Only in the mountain strongholds, and in dens and caves among the hills, could the people preserve their liberty and the produce of their fields. At last, however, the Israelites began "to cry unto the Lord," and a prophet is sent to stir up their religious and patriotic feelings. They were now obviously ripe for resistance to the enemy, at least portions of them. It is at this point that Gideon is introduced by the writer of the Book of Judges, "threshing wheat by the wine-press to hide it from the Midianites." The steps which he took to secure the freedom of his countrymen are too well known to require description. It is sufficient to say that, with a small but resolute force of Jewish patriots, he fell suddenly upon the enemy in the neighborhood of Mt. Gilboa, and utterly routed them. The pursuit of the fugitives was continued far across the Jordan, towards the Syrian Desert. The effect of the victory was most decisive. The Midianites, we are told, "lifted up their head no more," and the land of Israel enjoyed "quietness forty years in the days of Gideon." The people wished to make him king, but he religiously refused to tamper with the theocracy. He left behind him seventy sons.

GIEN, a small manufacturing t. of France, in the department of Loiret, is situated on the slope of a hill on the right bank of the Loire, 38 m. e.s.e. of Orleans. It is well built; is connected with the opposite bank of the river by a handsome stone bridge of twelve arches; has an old church (the church of St. Etienne), which has been much hurt by repairs; and, surmounting the hill, it has an interesting old castle, in a good state of preservation. Gien has important manufactures of faience and leather, and some trade in wine, corn, salt, saffron, and wool. Pop. '76, 6,493.

GIESELER, JOHANN KARL LUDWIG, German church historian, was. b. Mar. 3, 1792, at Petershagen, near Minden, where his father was a clergyman. After attending the orphan-house school and university of Halle, and after teaching for a year in that town, in Oct., 1813, he entered the army as a volunteer during the war of liberation. On the re-establishment of peace, however, in 1815, he returned to his former situation, where he taught for two years, and then became *conrector* of the gymnasium at Minden. In the following year, he was appointed to the directorship of a newly instituted gymnasium at Cleves, and published an essay on the origin and early fate of the gospels (*Historisch-Kritischer Versuch über d. Entstehung u. d. frühern Schicksale d. schriftlichen Evangelien* (Leip. 1818). This and other works were the occasion of his being called, in 1819, as ordinary professor of theology, to the university of Bonn, which had been established but shortly before. It was in this place that he began his great work on church history, of which 3 vols. appeared during his life, and two more after his death, under the editorship of E. R. Redepenning. This work, which brings down the history of the church to the most recent times, has been translated into English, and is so greatly valued for its method of picturing the times in happy quotations from contemporary writings, that the first three volumes have already gone through several editions. In 1831, Gieseler was called to a chair in Göttingen; became, in 1837, a consistorial councilor; and later, also knight of the order of the Guelphs. He was deeply devoted to his professorial duties, but took at the same time a practical interest in many benevolent schemes, especially in the Göttingen orphan-house. Besides numerous contributions to periodicals and publications on contemporary questions, he edited, among other things, the *Narratio de Bogomilis* of Euthymius Zygabenus (Gött. 1842), as well as Petrus Siculus's *Historia Manicheorum seu Paulicianorum* (Gött. 1846), and left behind him a volume on the history of dogmas, which was given to the world by Redepenning in 1856. He died July 8, 1854. A notice of his life will be found prefixed, by the editor, to the 5th vol. of his *Church History*.

GIES'SEN, the principal t. of the province of Upper Hesse, in the grand-duchy of Hesse, or Hesse-Darmstadt, is pleasantly situated in a beautiful and fertile plain at the confluence of the Wieseck and the Lahn, 34 m. n. of Frankfort-on-the-Main. Pop. '75, 13,980. It is chiefly deserving of notice for its well-endowed university (founded in 1607), which possesses commodious buildings for lecturing, and has well-appointed anatomical and other museums, a good library, observatory, a famous chemical laboratory (where the illustrious Liebeg experimented), botanical garden, etc. There are also various endowed schools, as the gymnasium, real-schule, etc., and several institutions for the preliminary instruction of different branches of medical knowledge, which are connected with the university. Giessen has manufactories for the preparation of tobacco, liquors, vinegar, soap, and leather, and is an active, thriving town.

GIFFORD, ROBERT SWAIN, b. Mass., 1840; an American painter almost entirely self-educated. His genius for art was probably inherited from his mother, and as he fortunately met with appreciation early in life, it became developed, and his friends assisted him in every way. He rapidly gained distinction, and became one of the foremost landscape-painters of the United States. His most successful paintings are from studies made in the east in 1870–71. He usually resides in New York city.

GIFFORD, SANFORD ROBINSON, 1823–80; b. New York; educated at Brown university; studied drawing and perspective in New York, and commenced his career as portrait painter. His attention was directed to landscape painting in 1864, when making a pedestrian tour among the Catskill mountains and the Berkshire hills. In 1851, he was elected an associate of the national academy, and in 1854, an academician. He passed two years and a half in Europe in pursuit of his profession. At the breaking out of the civil war Gifford joined the 7th New York regiment, and passed six months in active service. He subsequently visited Colorado and Utah, California, Oregon, British Columbia, and Alaska. His "Mansfield Mountain," "Shrewsbury River," "San Giorgio," "Tivoli," "On the Nile," "Venetian Sails," "Baltimore in 1862," are among the most characteristic of his pieces.

GIFFORD, WILLIAM, an English poet, translator, and critic, was b. at Ashburton, in Devonshire, in April, 1756. At the age of 15 he was apprenticed to a shoemaker, but exhibiting a very decided bias towards learning and poetry, he was enabled, through the kindness of some friends, to acquire an education, and to proceed to Exeter college, Oxford. Gifford's first publication appeared in 1794, being a satirical poem, entitled the *Baviad*, directed against the *Della Cruscans* (q.v.). It crushed them in a moment, like the fall of a rock. Flushed with success, Gifford next year produced the *Mæviad*, which satirized the offenses in the high places of the drama. In his third satire, Gifford assailed *Peter Pindar* (Dr. Wolcot); and the coarse and witty doctor, the breath of whose nostrils was literary warfare, rushed to the fray with *A Cut at a Cobbler*, and bespattered his opponent with mud from the kennels. Canning and his friends having at this time set up the *Anti-Jacobin*, Gifford was appointed editor, and through the influence he acquired among the leaders of at least one section of the political world, he was appointed to offices, the joint emoluments of which amounted to £900 per annum. In 1802, he translated *Juvenal*, and appended to his work a sketch of the poet's life. He edited the works of Massinger, Ford, Shirley, and Ben Jonson, and in his notes assailed former editors with the utmost ferocity. In 1808, he was appointed editor of the *Quarteerly Review*, started by sir Walter Scott and his friends in opposition to the *Edinburgh*. The periodical under his charge attained great influence, and he continued his editorial duties till within two years of his death. He died in London, Dec. 31, 1826.

Gifford possessed much satirical acerbity and poison, but as a poet he holds no rank whatever. As annotator and editor of the old English dramatists, he did good service, but his labors in this field are disfigured by suspicion and malignity. As a critic, he was bitterly partial and one-sided, and his praise and blame depended on the political leanings of the writer. Leigh Hunt was to be pursued like a wild-beast, because he was a liberal; and the flower-garden of *Endymion*, every rose of which was fed by the dews of paradise, was to be trampled upon with critical hoof, because Keats was known to have written a sonnet in praise of Hunt, and was understood to be his private friend. Gifford had been rudely nurtured; he lived in a time of great political uncharity; and if a portion of the bitterness he displayed may be set down to natural disposition and turn of mind, the larger part, perhaps, must be explained by the pressure of the times in which he lived.

GIFT, in English law, means a gratuitous transfer of property. Any person is at liberty to do what he pleases with his own property, and to give it away with or without consideration, if he is so inclined. When he gives away goods or chattels, mere delivery of possession, accompanied by words of gift, is sufficient to transfer the property, and then the transaction is irrevocable. But if he does not give possession of the goods at the same time, then, in order to be binding upon him, he must execute a deed or writing under seal. The reason of this is, that a mere verbal promise, without some legal consideration, is nugatory and revocable; whereas, when he executes a deed, he is stopped from ever afterwards denying it. Where the property given is not personal, but real, then a deed is in general absolutely necessary to transfer the property. A will

is the most familiar example of a gift of property both real and personal, for the testator generally, in such a case, gives away his property gratuitously. Each gift of personalty by will is better known under the name of a legacy; and a gift of land is generally called a devise.

As sometimes the power of giving away property gratuitously is abused, in order to defraud and defeat creditors, it is provided by statute that a voluntary conveyance, whether of chattels or land, made by a person who is at the time insolvent, shall be void as against such creditors; and they are entitled, accordingly, to recover the property from the donee (13 Eliz. c. 5). The gift, however, even in such a case, stands good against the donor himself. So, if any person give by deed gratuitously any land, and then sell the same land, the gift will be void against the *bona-fide* purchaser (27 Eliz. c. 4).

There is a peculiar kind of gift, or rather a gift made in peculiar circumstances, called a *donatio mortis causa*, i.e., a gift made by a person on death-bed of some personal property, such as chattels, money, bills of exchange, etc. Such gifts are held good, if they comply with certain conditions. This is in substance a mode of giving personal chattels to a particular individual, without the necessity or intervention of a will; but such gifts are so often afterwards disputed, that it is better to include them in a will.

In Scotland, a gift may be made of goods in the same manner as in England; but it is usually called a *donation* (q.v.). Gratuitous alienations by persons in insolvent circumstances are also held to be void as against creditors (stat. 1621, c. 18). Though it is competent in Scotland to make a gift of goods or money by merely delivering the possession thereof, accompanied by words of gift to the donee, still there is this peculiarity, that if the transaction is afterwards impeached, it can only be proved in Scotland by the donor's writ or oath, no matter how many witnesses may have been present; whereas, in England, it can be proved by ordinary witnesses, like any other fact.

Gift, in the law of Scotland, is also often used to denote a grant or appointment by the crown or a court, such as gifts of non-entry, escheat, bastardy, tutory, etc.

GIFTS, SPIRITUAL, are not the common fruits of faith, but special manifested powers of the Christian life conferred and directed by the Holy Spirit for promoting the welfare of the church. Each gift is the principal spiritual endowment of an individual Christian by which he is to do his part in advancing the general good. While it is supernaturally wrought and graciously bestowed, it is also in accordance with the intellectual and moral qualities of the individual which are themselves also gifts of God. These natural powers it arouses to greater and nobler action. The gifts of grace are manifold, according to the numerous powers of the soul and to the necessities of the church, and by their fullness and variety they display more richly the variegated grace of God, while they all have one origin and are the work of the same spirit. While some one gift was often specially suitable for one man, several were, sometimes, bestowed on the same person, either because his natural endowments were suited to them, or because his special work required them. A combination of them was conferred on the apostles because of their varied official relations to the church. Yet even they were not all equally endowed, or with the same gifts. John, it has been said, was specially gifted with love, spiritual knowledge, and prophetic vision; Peter, with ability to govern the church, to work miracles, and to discern spirits; James, with the power of faithful superintendence of a congregation; Paul, with varied endowments, comprising those of all the rest. Spiritual gifts have been variously arranged by different writers; Dr. Philip Schaff proposes the following classification: 1. "*Gifts of feeling and worship*; including speaking with tongues, interpretation of tongues and prophetic discourse. 2. *Of knowledge and theology;* including wisdom, knowledge, teaching, and discerning of spirits. 3. *Of will and church government;* including ministration, government, and miracles. Back of all is faith, as the motive power, taking up the whole man and bringing all his faculties into contact with the divine spirit, and subjecting them to his guidance and control."

GIGG, GIGA or GIGUE, the name of a short piece of music, much in vogue in olden times; of a joyful and lively character, and in $\frac{6}{8}$ or $\frac{12}{8}$ time, sometimes in $\frac{3}{8}$; used formerly as a dance-tune, and often introduced as a movement of a larger composition It consists of two parts of eight bars each, and the shortest notes are quavers.

GIGNOUX, FRANCOIS REGIS, b. France, 1816; studied art at Lyons and in the school of free art in Paris, and with Delaroche. In 1840 he came to the United States. His pictures are studies of nature in her more cheerful aspects. Among his productions are "Spring;" "The First Snow;" "The Indian Summer;" "Niagara in Winter;" "The Bernese Alps at Sunrise;" and "Niagara by Moonlight."

GIJON, a fortified t. and seaport of Spain, in the province of Oviedo (the former Asturias), and 20 m. n.n.e. of the t. of that name, stands on a low peninsula projecting northward into the bay of Biscay. It is the best and most regularly built town in the province; is partly surrounded by old walls, and is defended by an old castle and by coast batteries. It has a good port, at which steamers call regularly. There are manufactures of stone-wares, hats, and linen fabrics; nuts and other fruits are exported. Bermudez, the historian of Spanish art, was born here. In 718, the Moors having been defeated at the battle of Canicas, were compelled to abandon Gijon, of which they had made themselves masters. Pop. 10,000.

GIL, San (sometimes called *St. Giles*). a small t. of the United States of Colombia, in the department of Boyaca, stands in lat 6° 25′ n., and in long. 73° 40′ w., 64 m. s.w. of Pamploua. It was founded in 1690, has a college and manufactures of tobacco and cotton fabrics, and a good trade in agricultural produce. Pop. 6,000.

GIL, Vicente, the father of the Portuguese drama, was b. about 1470, or according to others, about 1485, whether at Guimaraes, Barcellos, or Lisbon, is disputed. In accordance with the desire of his parents, he studied jurisprudence at the university of Lisbon; but his poetical tastes soon drew him away from that science, and his inclination was possibly confirmed by the favorable reception of his first poetical essay at the court of Emanuel the great. This was a pastoral in Spanish, which was represented before the court in 1502, to celebrate the birth of the prince who became John III. The queen, Beatrice, Emanuel's mother, was so pleased with the piece, that she wished it to be repeated at the following Christmas; but Gil produced a new work for the occasion, also in Spanish, and in dramatic form; so that the introduction of the drama into Portugal coincides with the year of the birth of John III. Gil continued at all the more important festivals to produce similar dramatic pieces, in the performance of which not only he and his daughter Paula, who was a distinguished actress and poet, but king John also, took part. His fame spread beyond his own country, and Erasmus, declaring him to be the greatest dramatist of his time, is said to have learned Portuguese for the purpose of reading his works. At home, however, he had detractors, whom he sought to silence once at a party by composing impromptu, on a given proverb, the farce *Ines Pereira*, which is his best piece. Complaints in his works seem to indicate that the court was not liberal enough to keep him from want in his later years. He died probably soon after 1536. His works were edited by his son in 1561, and again in 1585 after undergoing castigation by the inquisition. It was not until our own times that a reprint of Gil's works, as complete and correct as possible, was undertaken by Barreto Feio, and Monteiro (3 vols., Hamb. 1832). Not only does Gil possess historical importance as having laid the foundation of a national theater in Portugal, but his works deserve study from their intrinsic poetical and dramatic worth. He has been called the Plautus of Portugal.

GI'LA, Rio, a river of North America, has its origin in the state of New Mexico, in lat. about 32° 45′ n., long. about 108° 30 w.; and, after a westward course of nearly 450 m., joins the Colorado, about 70 m. above the fall of that river into the gulf of California. For more than one half of its course it passes through mountains, and in some places is wholly inaccessible, being imprisoned within walls of perpendicular rock nearly 1000 ft. high. The Gila is navigable for flat-boats for about 180 miles. Numberless ruins of stone-built houses, among which fragments of pottery are found, occur all along the banks of this river, proving that at some past period the district must have been much more populous than it now is. One of these ruins, a structure of three stories in height, is still in a good state of preservation.

GILBERT, Sir Humphrey, 1539–83, an English navigator, b. in 1539 in the co. of Devon, second of the three sons of Otho Gilbert, of Greenway. By his mother's side, he was half brother to sir Walter Raleigh, who resembled him in many points of character, and whose early life was largely influenced and guided by his example. Educated first at Eton and then at Oxford, he was destined by his father for the law; but being introduced at court by Raleigh's aunt, Catherine Ashley, he obtained the special favor of the queen, and was thus enabled to follow his natural inclination for active enterprise. Recommended by royal letter to sir Philip Sidney, he received from him an appointment in the army in Ireland; and his services contributed so powerfully to put down the rebellion raging there, that in 1570 he was made a knight and rewarded with the government of Munster. He next served for about five years in the Netherlands, being the first English col. intrusted with command of English forces in that country. Upon his return to his native land, he wrote a remarkable treatise on a subject which, at that time, occupied the minds of men, the possibility of a north-west passage to India; which was published in 1576, without his knowledge, by George Gascoigne as *Discourse of a Discoverie for a New Passage to Cataia.* In June, 1578, Gilbert received letters-patent authorizing himself, his heirs, and assigns, to discover, occupy, and possess such remote "heathen lands, not actually possessed of any Christian prince or people as should seem good to him or them." Disposing not only of his patrimony, but also of the estates in Kent, which he owned through his wife, he at once prepared to put the permission to use, and was joined in the enterprise by his brother Raleigh. By the end of the summer of 1578, a fleet of 11 sail, with 400 mariners and men-at-arms, was collected off the coast of Devon; but the gallant projectors were singularly unfortunate in the character of some of their associates. Dissensions broke out among the captains, and disorder among the crews. Knollys, for example, boasted that, as a kinsman to royalty, he was of more value than 20 knights, and insolently rejected Gilbert's invitation to dinner; while his men, encouraged by their captain's conduct, filled the town of Plymouth with uproar and riot, which finally culminated in murder. It was not until Nov. 19 that Gilbert set sail, with his forces reduced to seven ships and 150 men. The history of the voyage is involved in obscurity; but about the beginning of the summer, or a little earlier, in 1579, the fleet returned to England, with little, it would appear, to

report, except that it had lost one of its chief ships and one of its bravest captains, Miles Morgan, in an encounter with the Spaniards. Gilbert lent his three ships to the government for service against the Spaniards on the Irish coast; but in July 11, 1582, we still find him complaining to Walsingham that he had not received the moneys that were due him, and that thus he was prevented from doing more for his queen and country. He was already planning a new expedition; and at length, in 1583, his fleet was ready. The queen, though she had at first dissuaded Gilbert from his purpose, and would not permit Raleigh to accompany him, wrote to him by his brother's hand, that she wished him "as great good hap and safety to his ship as if she herself were there in person," and sent him as a token a golden figure of an anchor guarded by a lady. On June 11, he departed from Plymouth with five sail; but on the 13th, the *Ark Raleigh*, which had been built and manned at his brother's expense, "ran from him in fair and clear weather, having a large wind." This desertion was the cause of no small displeasure to the admiral, and he wrote to sir George Peckham to solicit his brother to make the crew an example to all knaves; but it appears not improbable (according to Hayes in Hakluyt's collection) that the reason of their conduct was the breaking out of a contagious sickness in the ship. On Aug. 5, Gilbert landed in Newfoundland, and took formal possession of it in the queen's name; but proceeding southwards with three vessels, he lost the largest near cape Breton, and was at last constrained to return homewards with the *Golden Hind* and the *Squirrel* as the only remnant of his fleet. "On Monday, Sept. 9," reports Hayes, the captain of the *Hind*, "the frigate was near cast away, yet at that time recovered; and giving forth signs of joy, the gen., sitting abaft with a book in his hand, cried out unto us in the *Hind*: 'We are as near to heaven by sea as by land.' The same Monday night the frigate's lights were suddenly out, and it was devoured and swallowed up by the sea." So perished sir Humphrey Gilbert.

GILBERT, Sir John, b. 1817, exhibited his first picture in 1836, which was a water-color drawing of "The Arrest of Lord Hastings by the Protector Richard, Duke of Gloucester." In 1839, he first exhibited at the British institution, and since that date has sent many pictures there and to the royal academy. His best known oil pictures are: "Don Quixote giving Advice to Sancho Panza," followed by many other subjects from Cervantes; "The Education of Gil Blas;" a scene from "Tristram Shandy;" "Othello before the Senate;" "The Murder of Thomas Becket;" "The Plays of Shakespeare," a tableau in which the principal characters in each play are introduced; "Charge of Cavaliers at Naseby;" "A Drawing-room at St. James's;" "A Regiment of Royalist Cavalry;" "Rubens and Teniers;" "The Studio of Rembrandt;" "Wolsey and Buckingham;" "A Convocation of Clergy;" and "The Entry of Joan of Arc into Orleans" More recently he has exhibited at the royal academy "The Field of the Cloth of Gold;" "Tewkesbury Abbey;" "Mrs. Gilbert and Don Quixote and Sancho at the Castle of the Duke and Duchess;" "Crusaders and Richard II. Resigning the Crown to Bolingbroke;" "Cardinal Wolsey at Leicester Abbey;" and "Doge and Senators of Venice;" "Ready;" and "May-dew." He is familiarly known to the public as an illustrator of books, pictorial newspapers, and several weekly publications. He was for many years an artist contributor to the *Illustrated London News*. Most of the best editions of the British classics have been illustrated by him, and he spent many years in the illustrations of a rare edition of Shakespeare. In 1852, he was elected an associate, in 1853 a member, and in 1871 president of the society of painters in water-colors, in whose gallery he has been a constant exhibitor. He has been knighted.

GILBERT, William, a distinguished natural philosopher and physician, was b. in 1540 at Colchester, of which town his father was recorder. He was a member and subsequently fellow of St. John's college, Cambridge; was B.A. in 1560, M.A. in 1564, and M.D. in 1569. About the year 1573, he settled in London, joined the college of physicians, and practiced with so much reputation, that he was appointed physician to queen Elizabeth. The time that he could spare from the duties of his profession was employed in philosophical experiments, particularly in relation to the magnet; and in these he was assisted by a pension from the queen. After holding various offices in the college of physicians, he was finally elected its president in 1600. At the death of the queen, he was continued in his office of court physician by James I., but he survived his royal mistress only a few months, and died a bachelor in Nov., 1603. His death seems to have taken place in London; but he was buried at Colchester, in the church of the Holy Trinity, where there is a handsome monument to his memory. He left his library, globes, instruments, and cabinet of minerals to the college of physicians. From his birthplace, he is generally designated as Gilbert of Colchester. His works are (1) *De Magnete, Magneticisque Corporibus, et de Magno Magnete, Tellure, Physiologia Nova*, fol., Lond. 1600 (reprinted at Stettin in 1633), of which there are several editions; (2) *De Mundo nostro Sublunari Philosophia Nova*, 4to, Amsterdam, 1651 (published from a MS. in the library of sir William Boswell). The first of these works has served as the basis of most subsequent investigations on terrestrial magnetism; and (to use the words of prof. Whewell in his *History of the Inductive Sciences*) it "contains all the fundamental facts of the science, so fully examined, indeed, that even at this day we have little to add to them." He establishes the magnetic nature of the earth, which he regards (as

the title of his work indicates) as one great magnet; and he conjectured that terrestrial magnetism and electricity were two allied emanations of a single force; a view which was only demonstrated with scientific strictness more than two centuries afterwards, by Oersted and Faraday. Gilbert was the first to use the terms "electric force" and "electric attraction," and to point out that amber is not the only substance which, when rubbed, attracts light objects, but that the same faculty belongs to the resins, sealing-wax, sulphur, glass, etc.; and he describes how to measure the excited electricity by means of an iron needle moving freely on a point. Galileo pronounced him "great to a degree that might be envied;" and the publication of his treatise *De Magnete* will always be regarded as constituting an epoch in the history of magnetism and the allied sciences.

GILBERTINES, a religious order in the Roman Catholic church, specially noteworthy as being of English origin. It was founded in the 12th c. by St. Gilbert, a native of Sempringham, in Lincolnshire. The rule of the order was mainly derived from that of the canons regular of St. Augustine. St. Gilbert also founded an order of nuns after the Benedictine institute. Both orders were approved, and had numerous convents in England at the time of the reformation, when they shared in the general suppression.

GILBERT ISLANDS, a group on the s.w. coast of the archipelago of Terra del Fuego, offer a good harbor in Doris cove. Another cluster of the same name, comprising 15 coral islands, forms part of the Mulgrave archipelago in the Pacific, between lat. 1° s. and 2° 30′ n., and long. 172° and 174° 30′ e., and contains a population of 60,000. The two largest are known as Drummond's isle and Knox's isle; the former 30 m. long by rather more than ½ m. broad, the latter 20 m. long. The inhabitants resemble the Malays in appearance, and are divided into three classes—chiefs, landholders, and slaves. The chief, almost the only, cultivated products, are cocoa-nut and the pandanus.

GILBERT DE LA PORRÉE, (1070–1154), a scholastic philosopher, born at Poictiers. He studied philosophy under Bernard of Chartres, and theology under Anselm and Radulfus of Laon. He lectured first at Chartres, as church teacher, and afterwards at Paris, and in both places acquired great distinction. His reputation led to his being recalled to his native city, of which, in 1141, he was made bishop, but continued none the less a metaphysician, mingling his favorite science with theology, and resorting for proof and illustration, oftener to Aristotle than to the Scriptures or the fathers. His philosophy was realistic and his style obscure, At the council of Rheims, in 1148, he was accused of holding erroneous views concerning the nature of God. These views proceeded from the metaphysical notion that pure or abstract being is prior in nature to that which exists or is manifested. This pure being is God, in distinction from the triune God, as existing and known to men. The pure form of being, that by which God is God, must be distinguished from the three persons who are God by participation *in this form.* The form or essence is one, the persons or substances are three. It was this drawing of a distinction between divinitas and Deus that led to his arraignment and condemnation by the council. He submitted to their judgment, assented to the propositions drawn up as an expression of the true doctrine, and continued afterwards in his diocese, until his death, unmolested and on friendly terms with his former opponents. He wrote many books, some of which have been printed, and others are extant in manuscript. His chief logical work, *De sex Principiis*, was regarded in its day with reverence approaching that which Aristotle inspired. It furnished work for numerous commentators, among whom even Albertus Magnus did not disdain to appear.

GIL BLAS, the hero of Le Sage's famous novel, represented as timid, yet audacious, well disposed, yet easily led astray, shrewd, yet easily gulled, good natured, but of loose principles. The novel is said to have been founded on a Spanish romance, the *Life of Guzman.*

GILBO'A, a Hebrew word signifying "bubbling fountain," is the name given in the Old Testament to a range of hills, between 500 and 600 ft. high, overhanging the city of Jezreel, in the eastern side of the plain of Esdraelon. It is memorable as the scene of the defeat and death of king Saul and his three sons.

GILD. See GUILD.

GILDAS, or GILDUS, by some surnamed the wise, by others Badonicus, appears to have been born in the year 516. He visited France in 550, and Ireland in 565. He died in 570. His *De Excidio Britanniæ Liber Querulus* was first printed at London in 1525, and has been often reprinted both in England and on the continent. The best editions are Mr. Stevenson's, published by the English historical society (Lond. 1838), and Mr. Petrie's, in the *Monumenta Historica Britannica* (Lond. 1848). Gildas is a weak and wordy writer. Gibbon has justly described him in a single sentence: "A monk, who, in the profound ignorance of human life, has presumed to exercise the office of historian, strangely disfigures the state of Britain at the time of its separation from the Roman empire." His obscure and meager narrative may be divided into two periods—the first extending from the first invasion of Britain by the Romans to the revolt of Maximus, at the close of the 4th c.; the second, from the revolt of Maximus to the author's own time. The second portion is even more unsatisfactory than the first.

GILDING. There are many processes of gilding, varying with the nature of the substance to be gilded, and the kind of effect required to be produced, but they may all be classified under three heads—namely, 1st, mechanical gilding; 2d, chemical gilding; 3d, encaustic gilding.

The first is used chiefly for gilding wood, plaster of Paris, leather, paper, and other substances. If the object to be gilded is a picture or mirror frame, consisting of a plain wooden molding, then after getting a coat of oil-paint, from 4 to 10 coats of fine whiting mixed with fine glue are put on, each in its turn being smoothed with pumice-stone and fine sand-paper. This done, a coat of gold-size is given to those parts which are not to be burnished; but those which are, receive only a coating of clear animal size. Both of these prepared surfaces now receive the gold-leaf, which is laid on by means of a broad thin brush called a *tip*, and further pressed on with a thick soft-haired brush. Those parts which have been gold-sized are in this way oil-gilt, and will stand washing; while such portions as have been gilded on the size preparation in order to be burnished, will not bear soap and water. If the picture frame is much enriched with raised ornament, then the various coatings of whiting are not smoothed with pumice or sand-paper. In many cases, and especially with outside work, the surface to be gilded is previously prepared with oil-paint and gold-size alone. The *gold-size* used for oil-gilding is of different kinds. Sometimes it consists of boiled linseed-oil and ground ocher alone. Another kind has copal varnish and turpentine in addition. Japanners' gold-size is a mixture of ½ lb. of linseed-oil, 2 oz. of gum-animi in powder, and some vermilion.

Japanners' gilding.—Where gilt ornaments are to be put on a japanned ground, they are, by one method, painted with gold-size, and gold-leaf afterwards applied. By another way, rather more than the space the ornament is to occupy is wholly covered with gold-leaf, adhering with isinglass. The ornament is then painted on with asphaltum, which protects the gold beneath it while the superfluous leaf is being washed away. A little turpentine will then remove the protecting asphaltum so as to display the gilt ornament.

False gilding, although an old invention, has become in recent years an important trade in Germany. It is usually applied to moldings for pictures, mirrors, and room decoration. The molding intended to be gilded in this way is first covered with silver leaf or tin foil on a surface prepared as above, and then coated with a yellow varnish. A cheap and very durable imitation of genuine gilding is thus obtained, with which most of the less costly picture-frame moldings are now covered.

Chemical gilding.—Metals are now usually gilded by the process of electro-gilding (see GALVANISM), but besides this, various methods of chemical gilding have been adopted, and some are still in use.

Water or wash gilding, as it is somewhat inappropriately termed, consists in applying to metal a paste formed of an amalgam of gold, and afterwards evaporating the volatile mercury by heat, which leaves the gold firmly adhering to the surface of the metal. In preparing the amalgam, about eight parts of mercury to one of gold are used, but when this is squeezed through chamois leather, some mercury is removed, so that the amalgam actually applied contains about 33 per cent of gold. The metal to be gilded is cleaned with acid, brushed, and rubbed with bran or sawdust to make its surface perfectly clean. By means of a wire brush a solution of nitrate of mercury is then applied to it along with a portion of the gold amalgam. The mercury is driven off by heating at a charcoal fire, and the gilt surface is then ready for *burnishing*, which is done by rubbing it with a hæmatite burnisher. The *deadening* is produced by coating the surface with a mixture of sea salt, niter, and alum, and applying heat. Although modern appliances have diminished the evil, water gilding is still injurious to those who work at it; from the effect of the mercury fumes. It is worth noticing that this old process of gilding, although the contrary is often believed, is really better and more durable than electro-gilding. It is asserted that to the introduction of the latter method is to be attributed the decline of the once prosperous gilt button trade; at all events, the more costly kinds of decorative work in metal are now gilded as of old by the mercury process. Thirty thousand buttons, one inch in diameter, may be gilded with one ounce of gold; 14 or 15 thousand is the number over which this quantity is commonly spread.

Gilding by Immersion.—For this purpose a solution is used which slowly attacks the metal to be gilded, and at the same time deposits on its surface an equivalent of gold. Elkington's patent solution is made by dissolving ¼ oz. troy of fine gold in 2¼ oz. of nitro-muriatic acid, heating this until red and yellow vapors cease to be evolved, then diluting with 1¼ pint of distilled water, adding to this 1 lb. of bicarbonate of potass, and boiling for two hours. The article to be gilded is dipped into this at nearly the boiling heat, and agitated in it for about a minute. Talbot's patent solution is made by adding a solution of gold to a solution of gallic acid in water, alcohol or ether. The articles are dipped as above.

The method called *Grecian gilding* is a process intermediate between the above and water gilding. Sal ammoniac and corrosive sublimate are dissolved in nitric acid, and gold is dissolved in this solution, which thus becomes a mixture of chloride of gold and nitrate of mercury with some ammonia. This solution, on being applied to a surface

of silver, immediately blackens it, but upon the application of heat, it is richly gilded.

Most articles that are gilded by either of the above chemical methods, or by electro-gilding, are submitted to an after-process of *coloring*. This consists either in acting upon the surface with a saline solution, and heating the article afterwards, or in coating it with a kind of varnish of bees'-wax and yellow-ocher, and then burning it off. Various saline solutions are used, many of which are carefully guarded trade secrets. 1 oz. alum, 1 oz. of common salt, and 2 oz. niter, dissolved in half a pint of water, is recommended. Also 24 parts of niter, 10 alum, 5 sulphate of iron, 5 sulphate of zinc boiled together in sufficient water to form a paste when cooled, with continual agitation. The articles are immersed in this, and then heated till the desired color is obtained.

Cold gilding.—For this a gilding powder is first prepared by dissolving 5 dr. of pure gold and 1 dr. of copper in 10 oz. of nitro-muriatic acid, then moistening clean linen rags with the solution, and burning them to ashes. These ashes contain finely divided gold, which may be applied to surfaces of copper, brass, or silver, by simply rubbing it over them with a piece of cork moistened with a solution of common salt in water.

Sword-blades, lancets, and other steel articles are gilded in fancy devices by drawing the design with a camel's-hair pencil moistened in a solution of gold, prepared by agitating ether with a solution of terchloride of gold, and decanting the light liquid which floats on the top. Steel or iron can be gilded in a more durable manner by heating it and then applying gold leaf.

Silks, artificial flowers, ivory, bone, etc., may easily be gilded by immersing them in, or painting them with, a neutral solution of 1 part of terchloride of gold to 4 or 5 of water, and then exposing them in a vessel containing hydrogen gas, which readily combines with the chlorine, and reduces the gold to the metallic state.

Encaustic gilding is usually applied to glass and porcelain. The gold is first obtained in a finely divided state by precipitating from the chloride with protosulphate of iron, or by simply heating the chloride. This powder is ground up with $\frac{1}{12}$ of its weight of oxide of bismuth and some borax and gum water, and then painted on the ware. It is then heated till the borax is vitrified and the gold thereby fixed. Sometimes the gold is ground with turpentine, or an amalgam of gold is used. It has a brown dingy appearance when it leaves the kiln; the gold luster is brought up by burnishing.

GILDING METAL. The metal of which gilded goods are made, is required to have as nearly as possible the color of gold, so that when the surface-gilding is worn off at the more exposed parts, the difference of color will not be readily apparent. This is obtained by making a kind of brass having a much larger proportion of copper than common brass.

The following are three recipes from among a variety in use: 1st, 6 parts copper, 1 common brass; 2d, 4 parts copper to 1 Bristol brass; 3d, 13 parts copper, 3 parts brass, 12 parts tin. The last is much harder than No. 1 or 2.

GILEAD (in Eng. "region of rocks") was a mountainous district on the e. side of the Jordan, bounded on the n. by the river Hieromax (the modern *Sheriat-al-Mandhûr*), which separated it from the rich levels of Bashan; on the e. by the desert table-lands of Arabia; on the s. by Moab and Ammon; and on the w. by the Jordan. In spite of its name, the vegetation is luxuriant, especially in the middle, and round the brook Jabbok, where forests of oak and terebinth occur. The hills are not very high; they have broad summits almost like table-lands, "tossed," says prof. Stanley (*Sinai and Palestine*), "into wild confusion of undulating downs." Gilead anciently produced gums and spices. It was given by Joshua to the tribes of Gad and Reuben, because of the multitude of their cattle, and, as a frontier land, was much exposed to invasion.

GILES, a co. in s.e. Tennessee, on the Alabama border, watered by Elk river and intersected by the Louisville and Great Southern railroad; 600 sq. m.; pop. '70, 32,413—12,738 colored. The surface is uneven and the soil fertile, producing wheat, corn, cotton, butter, etc. Co. seat, Pulaski.

GILES, a co. in s.w. Virginia, on the Kanawha river; 300 sq. m.; pop. '70, 5,875—598 colored. The surface is high and rugged, with many mountain peaks. Chief productions, wheat, corn and hay. Co. seat, Pearisburg.

GILES, HENRY, b. Ireland, 1809; educated in the Roman Catholic church, but changed his religious opinions several times, and finally became a Unitarian pastor at Greenock, and afterwards at Liverpool. In 1840, he came to the United States, where he was soon recognized as an able lecturer. He has published *Lectures and Essays*, *Christian Thoughts on Life*, and *Illustrations of Genius in some of its Applications to Society and Culture*. He has also written largely for periodicals and newspapers. One of the most successful subjects chosen by him was the *Genius and Writing of Shakespeare*.

GILES, SAINT (Ægidius, Egidio, Gil, or Gilles), according to the *Breviarium Romanum*, was an Athenian of royal descent, and from his earliest years distinguished for piety and charity. On the death of his parents he, while still young, distributed among the poor his entire patrimony, including his very tunic, which garment effected a mirac-

ulous cure upon the poor sick man to whom it had been given. Shrinking from the publicity of this and many other (apparently) involuntary miracles, he betook himself to Provence, where, after a residence of two years with St. Caesarius at Arles, he withdrew into the solitude of the neighboring desert, living upon herbs and the milk of a hind which came to his cell at stated hours. Here he was discovered by the king of France, who, on a hunting expedition had tracked the hind to the hermit's cave. With the reluctant consent of Ægidius, a monastery was now built on the spot, he being appointed its first abbot. The functions of this office he discharged with prudence and piety until his death, which occurred some years later.

GILES, WILLIAM BRANCH, 1762–1830; b. Va.; studied at Princeton college, but did not graduate; was admitted to the bar, and in 1790, elected to congress, and afterwards several times re-chosen. He was United States senator for 12 years, and governor of Virginia from 1827 to 1830. He was at first a federalist, but finally joined the Jeffersonian democrats. His fame was in a measure owing to the able reply he made to an absurd attack upon Alexander Hamilton, the secretary of the treasury. Giles published *Political Letters to the People of Virginia.*

GILGAL. Three towns of this name are mentioned in the Bible. The first and most important was situated "in the e. border of Jericho," on the border between Judah and Benjamin. Josephus places it 50 stadia from Jordan and 10 from Jericho, but these measurements do not agree with the position of Jericho with respect to Jordan. Jerome places Gilgal 2 Roman m. from Jericho, and speaks of it as a deserted place held in wonderful veneration by the natives. This site, which in the Middle Ages appears to have been lost—Gilgal being shown further n.—has lately been recovered by a German traveler (Schokke), and fixed by the English survey party. It is about 2 m. e. of the site of the Byzantine Jericho, and 1. m. from the modern Erlha. A fine tamarisk, traces of a church (which is mentioned in the 8th c.), and a large reservoir, now filled up with mud, remain. The place is called Jiljûlieh, and its position north of the valley of Achor (Wâdy Kelt) and e. of Jericho, agrees well with the biblical indications above mentioned. A tradition connected with the fall of Jericho is attached to the site.

The second Gilgal, mentioned in Joshua in connection with Dor, appears to have been situated in the maritime plain. Jerome speaks of a town of the name 6 Roman m. n. of Antipatris (Râsel 'Ain). This is apparently the modern Kalkilia (vulgarly Galgilia), but about 3 m. n. of Antipatris is a large village called Jiljûlich, which is more probably the biblical town.

The third Gilgal was in the mountains near Bethel. Jerome mentions this place also. It appears to be the present village of Jiljilia, about 7 English m. n. of Beitin (Bethel).

GILFIL'LAN, GEORGE, critic and essayist, was b. at Comrie in 1813. He studied at the university of Glasgow, and at the divinity hall of the secession body, afterwards the United Presbyterian church, and in 1835 he was licensed to preach the Gospel. In March, 1836, he was ordained to the School Wynd church, Dundee. His works are numerous. They display a rich but reckless fancy, and wide literary sympathies, although deficient perhaps in refinement of taste. Among them are, *A Gallery of Literary Portraits* (1845); a second *Gallery* (1849); *The Bards of the Bible* (1850); *The Martyrs, Heroes, and Bards of the Scottish Covenant* (1852); a third *Gallery of Literary Portraits* (1854); *History of a Man* (1856); *Alpha and Omega* (1860); *Night:* a poem (1867); *Life of Sir W. Scott* (1870), and *Life of Dr. W. Anderson* (1873). In 1858, he commenced an edition of the *British Poets* in 48 vols. His contributions to periodicals have been numerous. He died Aug. 13, 1878.

GILGIT, a term applied to a secluded valley-state on a tributary of the upper Indus in India, and also to the river and its basin. The village is 4,800 ft. above the sea, and is built on a bed of river alluvium, which forms a terrace 30 or 40 ft. above the water. The place has suffered so much in recent wars that it will take long to recover its former prosperity.

GILL (low-Lat., *gilla*, a drinking-glass), a measure of capacity, containing the fourth part of a pint, or the 32d part of a gallon (q.v.).

GILL, JOHN, D.D., a Baptist minister, of some eminence as a theologian, and especially deserving of remembrance as one of the few English divines who have brought rabbinical learning to bear on the interpretation of Scripture, was b. at Kettering, Northamptonshire, Nov. 23, 1697. His parents were in humble circumstances, but they placed him at the grammar school at Kettering, from which, however, they were compelled to withdraw him before the completion of his course, on account of the enforcement of a rule requiring all the scholars to attend the parish church. He pursued his studies in private, and by his own unaided efforts, attained considerable proficiency in Latin, Greek and Hebrew. He afterwards devoted himself much to the study of the rabbinical writers. Having begun to preach at an early age, he became, in 1719, pastor of a Baptist church at Horseleydown, in Southwark; from which, in 1757, he removed to a new chapel in Carter-lane, near London bridge, and there continued to minister till his death, Oct. 14, 1771. Gill was a very voluminous author; many of his works were on

controversial subjects, often of mere temporary interest, but he produced also some which are still studied or consulted by divines. His first important work was an *Exposition of the Song of Solomon* (fol. 1728), in which he vindicated the authenticity of that book against Whiston. His *Exposition of the New Testament* appeared in three folio vols. in 1746, 1747, and 1748; and his *Exposition of the Old Testament* subsequently, at several dates, in six folio volumes. The complete work, a commentary on the whole Bible, has been since re-published (9 vols. 4to, Lond. 1809–10). Gill's other principal works are—*A Body of Doctrinal Divinity* (2 vols. 4to, Lond. 1769), and *A Body of Practical Divinity* (1 vol. 4to, Lond. 1770), which were afterwards republished together as one work (3 vols., Lond. 1795). He wrote also, as a controversialist, in defense of the doctrine of the Trinity and of Calvanism. He was a very high Calvinist. As a writer, he is extremely discursive and diffuse, by which the value of works full of thought and learning is much diminished. Gill received the degree of D.D. from the Marischal college and university, Aberdeen, in 1748. He sent to Dr. Kennicott a collection of quotations of the Old Testament in the Talmud, differing from the ordinarily received text, which Dr. Kennicott made use of and acknowledged in his great work.

GILL, THEODORE NICHOLAS, PH.D., b. New York, 1837; a naturalist residing in Washington, and a member of the national academy of science. He has published a great number of papers on fishes, mammals, and in other departments of natural history. Among the collected papers published by the Smithsonian institution are *Arrangement of the Families of Mollusks; Arrangement of the Families of Mammals*, and *Arrangement of the Families of Fishes.*

GILLEM, ALVAN G., 1830–79; b. Tenn.; graduated at West Point. He served on the Union side in the war of the rebellion, and was present in a number of engagements, and was promoted to brevet maj.gen. He took a prominent part in the re-organization of the state government of Tennessee.

GILLE'NIA, a genus of plants of the natural order of *rosaceæ*, sub-order *spiræeæ;* perennials, natives of the temperate parts of North America. The roots are used in medicine as a mild emetic, and in small doses as a tonic; and are often called INDIAN PHYSIC, sometimes *American ipecacuanha, Indian hippo, dropwort*, and *Bowman's root.* They are sometimes planted in shrubberies, on account of their graceful foliage. They grow to the height of about 2 feet.

GILLES, ST., an old t. of France, in the department of Gard, is situated near the borders of the department of Bouches du Rhone, on the Canal de Beaucaire, 12 m. s.s.e. of Nimes. Its abbey church, the west front of which is a masterpiece of Romanesque architecture, and is covered with the richest decoration, dates from the 11th c., and is the most notable building in the town. The neighborhood of St. Gilles produces a strong red wine, which is exported. Pop. '76, 5,705.

GILLESPIE, a co. in s.w. Texas, watered by tributaries of the Colorado; 900 sq.m.; pop. '70, 3,566—77 colored. The surface is rough, but good for pasturage. The chief productions are wheat, corn, and hay. Co. seat, Fredericksburg.

GILLESPIE, GEORGE, 1613–48; b. Scotland; a prominent member of the Presbyterian party in the Westminster assembly, entered the university of St. Andrews as a "presbytery bursar" in 1629. On the completion of a brilliant student career, he became domestic chaplain to Lord Kenmure, and afterwards to the earl of Cassilis, his conscience not permitting him to accept the episcopal ordination which was at that time in Scotland an indispensable condition of induction to a parish. While with the earl of Cassilis he wrote his first work, *A Dispute Against the English Popish Ceremonies Obtruded upon the Church of Scotland*, which, opportunely published (but without the author's name) in the summer of 1637, attracted considerable attention, and within a few months was found by the privy council to be so damaging that, by their orders, all available copies were called in and burnt. In April, 1638, soon after the authority of the bishops had been set aside by the nation, Gillespie was ordained minister of Wemyss (Fife) by the presbytery of Kirkcaldy, and in the same year became a member of the famous Glasgow assembly, before which he preached a sermon which pronounced so decidedly against royal interference in matters ecclesiastical as to call for some remonstrance on the part of Argyll, then lord high commissioner. In 1642, Gillespie was translated to Edinburgh; but the brief remainder of his life was chiefly spent in the conduct of public business in London. Already, in 1640, he had accompanied the commissioners of the peace to England as one of their chaplains; and in 1643 he was appointed to the Westminster assembly. Here he took a prominent part in almost all the protracted discussions on church government, discipline and worship, supporting presbyterianism by numerous controversial writings, as well as by an unusual fluency and readiness in debate. Shortly after his return to Scotland, Gillespie was elected moderator of the assembly; but the laborious duties of that office (the court continued to sit from July 12 to Aug. 12) told fatally on a constitution which, at no time very vigorous, had of late years been much overtaxed; and, after many weeks of great weakness, he died at Kirkcaldy. In acknowledgment of his great public services, a sum of £1000 Scots was voted, though destined never to be paid, to his widow and children by the committee of estates. A simple tombstone, which had been erected to his memory in

Kirkcaldy parish church, was in 1661 publicly broken at the cross by the hand of the common hangman, but was restored in 1746. Among the other of Gillespie's works may be mentioned the *Treatise of Miscellany Questions, wherein many useful questions and cases of Conscience are discussed and resolved*, published posthumously (1649); and *The Ark of the Testament* opened, being a treatise on the covenant of grace, also posthumous.

GILLESPIE, William Mitchell, 1816–68; b. New York; graduated at Columbia college. In 1845 he was appointed professor of civil engineering in Union college and held the chair till his death. Among his works are *Rome as Seen by a New Yorker; Roads and Railroads, a Manual of Road Making; Philosophy of Mathematics; The Principles and Practice of Land Surveying;* etc.

GILLIES, John, ll.d., known as a classical historian, the son of Robert Gillies, esq., was b. at Brechin, Forfarshire, Jan. 18, 1747. His youngest brother, Adam, was a judge of the court of session in Scotland, under the title of lord Gillies. Gillies was educated at the university of Glasgow; and, after a time, took up his residence in London, with the view of following literature as a profession. He subsequently acted for several years as traveling tutor to the sons of John, second earl of Hopetoun, who in 1777 settled upon him an annuity for life. In 1778, he published a translation of the *Orations of Isocrates and those of Lysias, with some Account of their Lives*, 4to; and in 1786 appeared the first part of his *History of Ancient Greece*. This work forms 2 vols. 4to, and 4 vols. 8vo. It was extremely popular on its first appearance, and is really far from being a discreditable performance, though much disfigured by verbosity and dull and prolix disquisition; but it has dropped out of notice nearly altogether since the advance of Greek scholarship in the present century, and the publication of the histories of Thirlwall and Grote. His *View of the Reign of Frederick II. of Prussia*, appeared in 1789, 8vo. In 1793, on the death of Dr. Robertson, he was appointed historiographer to the king for Scotland, with a yearly salary of £200. His other works are, a translation from the Greek of *Aristotle's Ethics and Politics: comprising his Practical Philosophy, with Notes; the Critical History of his Life; and a new Analysis of his Speculative Works*. 2 vols.; *Supplement to the Analysis of Aristotle's Speculative Works* (1804); *History of the World from Alexander to Augustus*, 2 vols., 4to (1807–1810); *Translation of Aristotle's Rhetoric* (1823). He died Feb. 5, 1836.

GILLIS, James Melvin, 1810–65; b. Dist. Col.; capt. in the navy. In 1838, he organized the first working astronomical observatory in the United States, and, in 1845, he finished the construction of a naval observatory. In 1861 he assumed the charge of the national observatory. He published *The United States Astronomical Expedition to the Southern Hemisphere in* 1849–52.

GILLMORE, Quincy Adams, b. Ohio, 1825; a graduate of West Point where he was assistant instructor. He became distinguished in the war of the rebellion at Hilton Head, in the capture of fort Pulaski, and in the reduction of forts Sumter and Wagner. He was made maj.gen. of volunteers, but preferred to retain his real rank of maj. of engineers. He published an account of the reduction of fort Pulaski, *Practical Treatise on Limes; Hydraulic Cements, and Mortars*, and *Engineer and Artillery Operations against the Defenses of Charleston Harbor in* 1863.

GILLOTT, Joseph, 1800–72; an English manufacturer known the world over for his steel pens. His first effort in this direction was in a garret, and the result, sold to small shop-keepers in Birmingham. They were stiff and awkward "barrel pens." From time to time he made important improvements, until his pens almost entirely superseded the goose-quill. Of late years the work of his own manufactory has reached the enormous number of 150,000,000 per annum. He accumulated vast wealth, and left at his country seat a remarkably valuable gallery of paintings and other works of art.

GILLS, or branchiæ, are the respiratory organs of those animals which obtain the oxygen necessary for their well-being not directly from the atmosphere, but from the air held in solution in the water in which they live. In animals modified for atmospheric respiration, the air enters the system to meet the blood, a peculiar set of movements, more or less complicated, being appointed for its constant renewal. In aquatic animals, on the other hand (excluding aquatic mammals), a different plan is required, in consequence of the small quantity of air contained in the water; and hence the aërating surface is extended outwardly, so as to yield a larger space than could be obtained in the interior. The blood is being perpetually driven along this surface, which is so constructed as to admit freely of the passage of air; and by the natural movements of the body, or by others of a special nature, a fresh supply of aërated water is constantly afforded. The chief forms of respiratory apparatus in different classes of animals are shown in the accompanying diagram, borrowed from

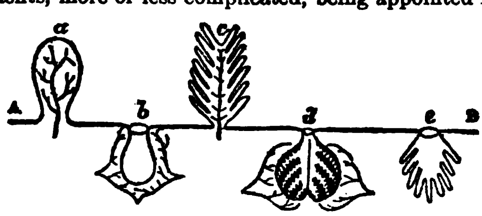


Fig. 1.

Dr. Carpenter's *Comparative Physiology*. "Let AB represent the general exterior surface of the body; then at *a* is shown the character of a simple *outward* extension of it forming a foliaceous gill, such as is seen in the lower crustacea; and in like manner, *b* may represent a simple *internal* prolongation or reflection, such as that which forms the pulmonary sac of the air-breathing gasteropods. A higher form of branchial apparatus is shown at *c*, the respiratory surface being extended by the subdivision of the gill into minute folds or filaments, as we see in fishes; and a more elevated form of the pulmonary apparatus is seen at *d*, the membranous surface being extended by subdivision of the internal cavity, as in birds and mammals. Lastly, at *e* is shown a plan of one of the "pulmonary branchiæ" of the arachnida, which forms a kind of transition between the two sets of organs—the extent of surface being given by gill-like plications of the membrane lining the interior of a pulmonic cavity."

We shall notice a few of the different forms of gills that occur in various classes. It is in the annelida that we find the first distinct organs of this kind. Their blood is transmitted to a series of gill-tufts, which are composed of a delicate membrane prolonged from the extreme surface, and which may assume the form of branching trees or of delicate brushes made up of a bundle of separate filaments. These tufts are supplied freely with blood-vessels; and fresh portions of blood and of water are being constantly brought into contact by the natural movements both of the animal and the surrounding medium, and by the action of the cilia covering the respiratory organs. The tufts are sometimes attached at intervals along the whole length of the body, as in *arenicola*, in which there are 13 pair (see ANNELIDA); while in other cases they occur about the head only. In the latter case, they are extremely beautiful, having the appearance of a flower endowed with the most brilliant tints. Two animals common in the aquarium, the *serpula* and the *terebella*, owe their resplendent beauty to these tufts (see figure under SERPULA). In all of the crustacea, excepting some of the lowest forms, whose general surface is soft, gills are present. The *branchiopoda*, belonging to the sessile-eyed crustacea, or *edriophthalma*, are so called because their fins or feet present the form of simple plates or flattened vesicles, which float in the surrounding fluid, and expose the blood to the oxygen which the water contains. The branchiæ may be appended to the thoracic limbs in the form of membranous plates (as in *amphipoda*), or to the abdominal limbs as subdivided lamellæ (as in *isopoda*), or the branchial plates may expand into vesicles attached to the thoracic feet (as in *læmodipoda*). Amongst the crustacea with eye-stalks, or *podophthalma*, the respiratory plates, in the order *stomapoda*, are external, and are appendages of distinct locomotive organs, each plate being divided into a series of small filaments or tubes, so as to resemble a broad feather. Their position is abdominal, as is seen in *squilla*. Here the gills have begun to assume more of the character they present in fishes, the laminated or leaf-like form being replaced by one in which the surface is greatly extended by minute subdivisions into delicate filaments. In the order *decapoda*, including the crab and lobster, the respiratory organs are of a more special character, and are lodged in branchial chambers protected by the carapace. A special apparatus is here found for the purpose of securing a constant current of water over the aërating surface. The gills in these animals are in the form of long, slender, quadrangular pyramids, and consist either of numerous thin plates or minute cylinders arranged perpendicular to the axis of the pyramid. There are 9 such branchial pyramids on each side in the crabs, while in the lobster there are 22. For further details on the respiratory organs of the crustacea, the reader is referred to prof. Owen's *Lectures on the Comparative Anatomy and Physiology of the Invertebrate Animals*, 2d edit., 1855, pp. 320–322.

In the sub-kingdom mollusca, we find several modifications of gills. In the *lamellibranchiata*, or common bivalves, there are, as a general rule, two gills on each side. Here the gills are internal highly vascular folds of the mantle lining the valves, and are strengthened by delicate jointed filaments, which support several rows of vibratile cilia, whose constant motion gives rise to regular respiratory currents. This form of gill may be readily examined in the oyster or common muscle. In the *branchiferous gasteropoda*, the form and position of the gills are very variable. In the *nudibranchiata* (see Alder and Hancock's splendid monograph on this order as occurring in the British seas), they are disposed, as their name implies, without any protection, over various parts of the body, where they often form beautiful tufts of delicate leaf-like or arborescent appendages, as may be seen in doris (q.v.). The highest and most numerous subdivision of the branchiferous gasteropoda—the order *pectinibranchiata*—derives its name from the peculiar comb-like arrangement of its gills, which have a special cavity at the fore part of the back, caused by an arching of the mantle. Finally, in the highest class of mollusks—the *cephalopoda*—the gills are the organs used for classification; there being two orders—viz., the *tetrabranchiata*, with four gills, and the *dibranchiata*, with two gills.

In the article FISHES, the gills are of necessity briefly noticed, but all details regarding them have been postponed to this article. The following remarks on the gills of fishes are condensed from prof. Owen's *Anatomy of the Vertebrates*, vol. i. pp. 475–88. In the *Cyclostomi*, which, if we except the lancelet, constitute the lowest order of fishes, and include the genera *myxine* and *petromyzon*, of which the hag and lamprey are examples, the branchiæ or gills are sacciform, with external spiracles, and six or seven in

number, on each side. Each gill-sac receives its proper artery either from the branchial artery or one of its branches. "The leading condition of the gills in other fishes may be understood," says prof. Owen, "by supposing each compressed sac of a myxine to be split through its plane, and each half to be glued by its outer smooth side to an intermediate septum, which would then support the opposite halves of two distinct sacs, and expose their vascular mucous membrane to view. If the septum be attached by its entire margin, the condition of the gill in the *plagiostomi* (sharks, dog-fish, rays, skates, etc.) is effected. If the septum be liberated at the outer part of its circumference, and the vascular surfaces are produced into pectinated lamelligerous processes, tufts or filaments proceeding from the free arch, the gill of an ordinary osseous fish is formed. Such a gill is the homologue, not of a single gill-sac, but of the contiguous halves of two distinct gill-sacs, in the myxines. Already, in the lampreys, the first stage of this bi-partition may be seen, and the next stage in the sharks and rays; consequently, in these fishes a different artery goes to the anterior branchial surface of each sac or fissure from that which supplies the posterior branchial surface of the same fissure; whilst one branchial artery is appropriated to each supporting septum or arch between the fissures, as it is to the liberated septum or branchial arch in the ordinary osseous fishes."—*Anatomy of Vertebrates*, vol. 1. p. 476.

The lampreys, myxinoids, and plagiostomes (sharks and rays) are termed fishes with "fixed gills," because in them each supporting septum of the anterior and posterior branchial mucous surfaces is attached to the pharyngeal and dermal integument by its entire outer margin, and the streams of water flow out by the same number of fissures in the skin as those by which they enter from the pharynx. In the osseous and in the ganoid fishes there are "free gills," the outer border of the supporting branchial arch being unattached to the skin, and playing freely backwards and forwards, with its gill-surfaces, in a common gill-cavity, which has a single outlet, usually in the form of a vertical fissure.

In the myxinoids (as the hag) there are six or seven branchial sacs on either side, and their outlets are produced into short tubes, which open into a longitudinal canal, directed backwards, and discharging its contents by an orifice near the middle line of the ventral surface; between the two outlets is a third larger one, which communicates, by a short duct, with the end of the œsophagus, and admits the water, which passes from that tube by the lateral orifices leading into the branchial sacs. These sacs, which are developed from the œsophagus, and which may be regarded as the simplest form of piscine gill, have a highly vascular, but not a ciliated, mucous membrane, which is arranged in radiating primary and secondary folds, so as to increase the surface. In the lampreys, there is a further separation of the respiratory from the digestive tract, for each internal blind duct communicates with a median canal, beneath and distinct from the œsophagus.

In all the higher fishes, the inlets to the branchial interspaces lie on each side of the fauces, and are equal in number with the interspaces; while, except in the plagiostomes, there is only one outlet on each side. These outlets vary extremely in size, being relatively largest in the herring and mackerel families, and smallest in the eels and lophioid fishes (as the Angler, q.v.). The length of time that different fishes can exist out of water depends on the modifications for retaining water in the branchial chambers. As a general rule, the chamber is largest when the outlet is smallest, as in the eels, blennies, and lophioids, and these are the fishes that survive the longest out of water, except in such cases as the climbing perch (q.v.) or *anabas*, in which the branchial apparatus possesses complex labyrinthic appendages. The main object of the gills of fishes being to expose the venous blood, in very thin-walled vessels, to streams of water, the branchial arteries rapidly sub-divide into capillaries, which constitute a network in one layer, supported by an elastic plate, and covered by a tesselated but non-ciliated epithelium. This covering and the capillary wall are so thin as to admit free interchange to take place between the blood, loaded with carbonic acid, on the one hand, and the aërated water on the other. The extent of respiratory surface is increased in various ways, of which, by far the most common is, "by the production of the capillary-supporting plates from each side of long, compressed, slender, pointed processes, extending, like the teeth of a comb, but in a double row, from the convex side of each branchial arch." The number of vascular plates or lamellæ attached to each branchial process has been estimated at 135 in the carp, 700 in the eel, 1000 in the cod, 1400 in the salmon, and 1600 in the sturgeon.

We now pass on to the consideration of these organs in amphibia or batrachia. In the lower or perennibranchiate members of this order, the gills exist permanently, but in the great majority they are mere temporary organs. The subject is briefly noticed in the article BATRACHIA; but one or two additional observations may be made. In the newt (*triton*), a little animal common in most parts of England, and readily kept in a vessel of fresh water, three pairs of external gills are developed, at first as simple filaments, each with a capillary loop, but speedily expanding and giving off looplets. The gill is covered with ciliated epithelium, which loses the cilia before the absorption of the organ, and this takes place after a few days of larval existence. In the larval frog, the gills, which are on a simpler plan, diminish about the 4th, and disappear on the 7th day. The parts of the branchial framework which supports the deciduous gills

never get beyond the cartilaginous stage. They thus readily shrink, and become more internal as the head increases in size. As the gills of the perennibranchiate amphibians, in all essential points, resemble those already described, it is unnecessary to notice them. The present article must be regarded as supplementary to RESPIRATION, ORGANS AND PROCESS OF, in which the comparative anatomy of the subject was altogether omitted.

GILLYFLOWER, a popular English name for some of the cruciferous plants most prized for the beauty and fragrance of their flowers, as wall-flower, stock, etc. The clove-pink also, the wild original of the carnation, is called *clove-gillyflower.* The name gillyflower has been regarded as a corruption of *July flower;* but in Chaucer it appears in the form *gilofre;* and the French *giroflée* indicates the true derivation from *girofle,* a clove, the smell of the clove-gillyflower being somewhat like that of cloves.

GILMAN, ARTHUR, b. Ill., 1837; educated in New York. He removed to western Massachusetts and gave his attention chiefly to education and religious instruction, and afterwards became editor of the publications of the American Tract society. He has published a *Manual of English Literature.*

GILMAN, CAROLINE, b. Mass., 1794; daughter of Samuel Howard, of Boston, Mass.; wife of rev. Samuel Gilman of Boston. She has written poems and other works, among which are *Jephthah's Rash Vow* (written at the age of 16), *Jairus's Daughter; Recollections of a New England House-keeper; Recollections of a Southern Matron; Ruth Raymond, or Love's Progress; Poetry of Traveling in the United States; Verses of a Lifetime; Mrs. Gilman's Gift Book; Oracles from the Poets;* and *Stories and Poems by a Mother and Daughter.*

GILMAN, CHANDLER ROBBINS, 1802–65; b. Ohio; educated in the university of Pennsylvania and began the practice of medicine in New York. In 1840, he was professor of obstetrics and diseases of women and children in the college of physicians and surgeons, and subsequently of medical jurisprudence. His literary work consisted of translating Bischoff's *On the Periodical Discharges of the Ovum;* in which he was assisted by Dr. Theodore Tellkampf, and compiling a work *On the Relations of the Medical to the Legal Profession;* and an edition of *Beck's Medical Jurisprudence.*

GILMAN, DANIEL COIT, LL.D., b. Conn., 1831; graduated at Yale, and was superintendent of schools in New Haven. In 1856 he was professor of physical geography in Yale College, and college librarian. In 1863 he was state superintendent of schools, and from 1872 to 1875 was president of the university of California. In 1875 he was chosen president of Johns Hopkins university, Baltimore. He has published many reports and addresses on scientific, educational, and historical subjects.

GILMAN, JOHN TAYLOR, 1753–1828; b. N. H. On the morning after the battle of Lexington he marched with 100 volunteers to Cambridge, Mass., and took service in the provincial army. He became assistant treasurer of New Hampshire, and afterwards treasurer; and in 1780 was a delegate to the Hartford convention to devise measures for defense. He was a member of the continental congress, and one of the commission to settle the war accounts of the states. In 1797 he was chosen governor of New Hampshire, and was re-elected thirteen times.

GILMAN, SAMUEL, D.D., 1791–1858; b. Mass.; graduated at Harvard in 1811. After filling the position of tutor in mathematics at Cambridge for two years (1817–19) he became, in the latter year, pastor of the Unitarian church in Charleston, S. C., filling the pulpit until his death. In 1856 he published *Contributions to Literature, Descriptive, Critical, Humorous, Biographical, and Poetical;* He also published *Memoires of a New England Village Choir; Pleasures and Pains of a Student's Life;* and translated Boileau's *Satires.*

GILMER, a co. in n. Georgia drained by the Coosawattee; 500 sq.m.; pop. '70, 6,644—117 colored. It is traversed by spurs of the Blue Ridge, and offers delightful scenery. Among its minerals are gold, iron, and marble. Corn, wheat, and butter are the chief productions. Co. seat, Ellijay.

GILMER, a co. in central West Virginia watered by the Little Kanawha; 512 sq.m.; pop. '70, 4,338—27 colored. The surface is rough and thickly wooded; the soil fertile and especially adapted to pasturage. There are deposits of salt and iron. The chief products are corn, oats, and butter. Co. seat, Glenville.

GILMORE, JOHN R., b. Mass., 1823; one of the founders of the *Continental Monthly,* a short-lived literary periodical. He has written a number of sketchy volumes over the signature of "Edmund Kirke." Some of his works are, *Among the Pines, My Southern Friends, Down in Tennessee, On the Border, Among the Guerrillas,* and a campaign life of James A. Garfield (1880).

GILO'LO, or HALMAHEIRA, one of the Moluccas or Spice islands, between 2° n. and 1° s. lat., and 127° 27′ to 129° e. long., to the e. of Celebes. It is very irregular in form, and consists of four peninsulas. Area, 6,300 sq.m. Pop., including the neighboring small islands, 27,500. The sultan of Ternate rules over the n. and s., the sultan of Tidore the e., and native princes the interior. Malays live on the coasts, Alfoors inland. The whole island is mountainous, and covered with forests. Gold is found. There

are buffaloes, oxen, wild swine, goats, etc. The soil is fertile, producing cocoa-nuts, sago, spices, bananas, bread-fruit, and fine wood. The exports are edible-nests, pearls, gold, mother-of-pearl, sago, spices, trepang, and tortoise-shell. The imports: opium, iron, cotton, manufactured and fancy goods.

GILPIN, a co. in n. central Colorado among the Rocky mountains, connected with Denver by the Colorado Central railroad; 150 sq.m.; pop. '70, 5,490. The whole district is from 9,000 to 10,000 ft. above the sea level. It is one of the richest gold mining regions in the country. Silver and copper are also found. The agricultural productions are not large. Co. seat, Central City.

GILPIN, BERNARD, 1517–83, an English clergyman of remarkable scholarship, diligence, liberality, and usefulness, b. at Kentmire, Westmoreland. He studied at Queen's college, Oxford, stimulated by the example and writings of Erasmus and giving great attention to the Scriptures in the original languages. Soon after graduation, he was chosen fellow of his college and took orders. On the opening of the new foundation of Christ church Wolsey made him one of the head masters. At that time the university was divided on the subject of the reformation. Gilpin at first took ground against it; but, in preparing himself with an honest mind to oppose it, he became convinced that it was in accordance with Scripture and the fathers, and embraced it. In 1552, he became vicar of Norton and was licensed by Edward VI. as a "general preacher." On queen Mary's accession, he resigned his living and went to Louvain, where he resisted all the efforts of the priests to win him back to the Roman church. Returning to England during the queen's life, he found the persecution of the Protestants still in progress. His uncle, bishop Tunstall, gave him the living of Easingdon and the rectory of Houghton-le-spring; protecting him also, notwithstanding his open avowal of Protestant opinions. Afterward, however, he was summoned to trial before bishop Bonner, but having broken his leg on the journey, before he was able to travel again the queen died. He then devoted himself again to the diligent prosecution of his parish work and to itinerant labors through the country. Queen Elizabeth offered him the bishopric of Carlisle, which he declined. He continued until his death rector of Houghton, residing constantly in his parish except when he visited the ruder parts of the county of Northumberland, into which he introduced more regular habits of life and more of Christian influences than had resulted from any previous labors. The parts of Redesdale and Tynedale are particularly named as the scenes of his labors. The people there, living on the borders of the two counties, had long led a lawless life, subsisting mostly on plunder. Gilpin went fearlessly among them, holding forth the commands and sanctions of Christianity, and did much to change the character of the country. Hence he was commonly called the "*northern apostle*," and for generations his name was repeated with reverence. His chief labors, however, were in his own parish of Houghton, which included 14 villages. It yielded him an ample income, being then, as now, one of the richest benefices in the north. He was a bachelor, and in hospitality resembled the character ascribed to the primitive bishops. Every fortnight 40 bushels of corn, 20 bushels of malt, and a whole ox were consumed in his house, beside ample supplies of many other kinds. Having a large and wide parish and a great multitude of people, he kept a table for them every Sunday from Michaelmas to Easter. The rectory house was also open to all travelers, and so great was the reverence which surrounded him that his liberality was rarely abused; even the most wicked were awed by it. His skill in settling differences was as celebrated as his hospitality and his preaching; his benevolence was wisely exerted in providing instruction for the young, including homely learning for poor children generally, and preparation for the universities for a select number of promising youths. Of these last, he kept 24 in his own house, the greater part of them being poor men's sons, on whom he bestowed meat, drink, clothing, and instruction. From them, and from the grammar school which he founded, he supplied the church of England with a great store of learned men. Of his scholars, he always maintained at least six at the universities at his own expense, and, after their graduation, charged himself with the care of their settlement. Bishop Carleton, who wrote his life, was one of these scholars. Gilpin was also assiduous in his attentions to the sick, and by his systematic beneficence won his second title of "*father to the poor.*"

GIL POLO, GASPAR, a Spanish poet, was b. at Valencia in the first half of the 16th century. While town-clerk of his native place, his talents for office became known to Philip II., who appointed him, in 1572, coadjutor to the president of the upper financial chamber of the kingdom of Valencia, and in 1580, sent him to superintend the royal patrimony at Barcelona, where he died. Before, however, his time was absorbed by business, Gil had occupied himself with poetry. Besides various lyrics, and his *Canto de Turia* in praise of his native city, he wrote a continuation of Montemayor's *Diana*, under the title *Primera Parte de Diana enamorada Cinco Libros, que prosique los Sieta de Jorge Montemayor*. This work appeared first at Valencia in 1564, the same year in which another continuation of Montemayor's pastoral was given to the world by a physician named Perez. Though inferior to the original romance in invention, Gil's continuation so greatly surpasses it, as well as the other continuation, in clearness of thought and expression throughout the metrical portions, that Cervantes exempts it from

the condemnation of Don Quixote's other books as deserving as much respect "as though Apollo himself had written it." The best edition of the *Diana enamorada* is that of Cerda, which is accompanied by a commentary on the *Canto de Turia* (Madrid, 1778; new ed., 1802). Biographers have generally confounded Gil with a son of his own name, who was a distinguished writer on jurisprudence.

GILRAY, JAMES, a celebrated caricaturist, b. in London about the middle of last century. He first became known as a successful engraver about 1784, and between 1779 and 1811, issued as many as 1200 caricatures, numbers of which, it is said, "were etched at once upon the copper without the assistance of drawings." They are full of broad humor and keen satire, the subjects of his ridicule being generally the French, Napoleon, and the ministers, though he often diverged to assail the social follies of his day. He died June 1, 1815. Gilray's drawings have often been published, but the best edition is that of M'Lean (accompanied by an illustrative description), in 304 sheets (Lond., 1830). An edition with life and times of Gilray, by T. Wright, was issued by Bohn (1851).

GILTHEAD, *Chrysophrys*, a genus of acanthopterous fishes of the family *sparidæ*, having a deep compressed body, a single dorsal fin, the anterior rays of which are spinous, the cheeks and gill-covers covered with scales, the teeth of two kinds, six conical teeth in front of each jaw, and four rows of oval rounded grinding-teeth in the upper jaw, three rows in the lower. They feed chiefly on mollusks, the shells of which their teeth enable them to crush to pieces. The species are numerous; inhabitants of the warmer seas. One species, the COMMON GILTHEAD (*C. aurata*), is found, but rarely, on the British coasts; it abounds in the Mediterranean, and is very much esteemed for the table. It seldom attains a length of more than 12 inches. It is generally found near the shore, in small shoals, and its presence is sometimes betrayed to fishermen by the noise which its teeth make in crushing shells. It is said to agitate the sand with its tail, in order to get at the mollusks concealed in it. The back is silvery gray, shaded with blue; the belly like polished steel; the sides have golden bands; and there is a half-moon-shaped golden spot between the eyes, from which it derives the name gilthead, the Latin name *aurata* (gilded), and the Greek name *chrysophrys* (golden eyebrow). From the Latin *aurata* comes the French name *dorade*. This fish was very generally kept in the *vivaria* of the ancient Romans, being much valued and easily fattened. Another species (*C. microdon*) is also found in the Mediterranean.—The name gilthead is also given to a British fish of a different family (*Labridæ*), a species of wrasse (q.v.).

GILT TOYS. This term is known in trade as a designation for small articles which are gilded, but is chiefly applied to the cheap jewelry which is almost exclusively manufactured at Birmingham. In that town this trade is very extensive, and employs thousands of persons and a considerable amount of machine power. Cheap jewelry of the most elegant forms is made from copper, which is drawn through rollers for the purpose, into small ribbons and wires, with elegantly embossed surfaces to represent the fine chasing employed on articles made from the precious metals. These the gilt-toy maker twists and solders into brooches, bracelets, rings, and a variety of trinkets, usually with a raised *bezel* for receiving a piece of polished colored glass, or a cheap stone. Previous to setting the glass or stone, the trinkets are strung on copper wires, and sent to the electro-plater, who gives them a coating of gold or silver, and returns them to the gilt-toy maker, who finished them by burnishing and by setting the imitation gems. In this way really beautiful imitation jewelry is produced at an incredibly small cost; and being coated with the precious metals in the pure state in which they are deposited by the electro-plating process, their spurious character is not easily detected by the uninitiated.

GIMBALS (Lat. *gemellus*, a twin), are two circular brass hoops used for suspending the compass-box on board ship, so that it may always rest horizontally, unaffected by the ship's motion. The outer hoop is attached to a box or other fixed object, while the inner is constructed so as to allow of its moving freely within the outer, to which it is attached by two pivots at the extremities of a diameter. The compass-box is attached to the inner hoop by two similar pivots at right angles to the former. Thus, the compass moves freely in two directions at right angles to each other, and can always retain its horizontal position, however the vessel may roll or pitch. Gimbals are often applied to other instruments, such as the mountain barometer, etc.

GIME'NA. or XIMENA See JIMENA.

GIMIGNA'NO, SAN, a very ancient t. of central Italy, in the province of Sienna and 22 m. s.s.w. of Florence, is situated on the top of a hill 1220 ft. above the sea. One of the most curious features of the town is the number, 14, of lofty square towers in so small a space, the largest of which is built on an arch under which passes a street, and was erected in 1298. Of the many churches and monasteries which the town once contained, most are in ruins. The principal of those still standing are the *collegiata* or *assunta*, which contains some fine old frescos by various masters: the chapel of *St Fina*, with frescos by D. Ghirlandajo; and the church of *St. Augustin*, begun in the 13th, but not completed till the end of the 14th c., also containing frescos. There has been of late years established in the suppressed monastery of San Domenico, a house of correction

for convicted females, who are sent here from all parts of the surrounding country. Pop. '71, 3,128.

GIMLET, a tool for boring holes in wood to receive nails, screws, etc., and generally used when the hole is to be larger than can be bored with a brad-awl. It has a conical screw point, followed by a groove for clearing, and is fitted in a cross or T handle. An improvement has lately been made by twisting the grooved part of the gimlet, so that it forms a long spiral groove.

GIMLI, in Norse mythology, a great hall at the world's southern end, brighter than the sun. It will stand when heaven and earth have passed away, and good and upright men will inhabit the place to all eternity.

GIMP, or GYMP, a kind of trimming for dress, curtains, furniture, etc., made either of silk, wool, or cotton. Its peculiarity is that fine wire is twisted into the thin cord of which it is made.

GIN is a machine used for raising weights, driving piles, etc., and consists of three poles, each from 12 to 15 ft. long, and 5 in. in diameter at the lower end, tapering to 3½ in. at the upper. The poles are united at the top, either by an iron ring which passes through them, or by a rope which is twisted several times round each, and to this "joint" a pulley is fixed. Two of the poles are kept at an invariable distance by means of an iron rod, in order that they may support the windlass which is attached to them, its pivots running in iron cheeks fixed to the poles. When the machine is to be used, it is set up over the weight to be raised; two blocks arranged according to the second system of pulleys (q.v.) are fixed, one to the top of the poles, the other to the weight; and the rope, after passing round both blocks, and over the pulley before mentioned, is attached to the windlass, by the revolution of which the weight can then be raised.—The name of gin is also given to a machine used for raising coal, etc., and also for communicating motion to thrashing-mills. It consists of an erect axis or drum, firmly fixed in sockets, to which are attached transverse beams, varying in number according to the power required. To the extremity of each beam a horse is yoked, and they are then driven round in a circle. If coal is to be raised, the horses must either be frequently unyoked, and turned in the opposite way, or the machine must be made reversible; the latter of which is found to be preferable, as a saving both of time and labor. This machine is now rapidly disappearing before the steam-engine.

GIN is a machine used for disentangling the fibers of cotton (q.v.)

GIN, or GENEVA, an alcoholic drink, distilled from malt or from unmalted barley or other grain, and afterwards rectified and flavored. The gin, which forms the common spirituous drink of the lower classes of London and its vicinity, is flavored very slightly with oil of turpentine and common salt; each rectifier has his own particular recipe for regulating the quantities to be used; but it is usually about 5 fluid oz. of spirit of turpentine and 3½ lbs. of salt mixed in 10 galls. of water; these are placed in the rectifying still, with 80 galls. of proof corn-spirit, and distilled until the feints begin to come over. It is then used either unsweetened or sweetened with sugar.

We derive the terms gin and geneva from the Dutch, who call the Hollands-gin (which is their national spirit), *genever*, which they have derived from the French *genièvre*, juniper. The origin of this name is, doubtless, to be found in the employment of juniper-berries in flavoring the spirit made in Holland, where it is an article of great manufacture, chiefly at Schiedam; hence it is often called *Schiedam* or Hollands, as well as geneva and gin. So extensive is the manufacture of this spirit in Holland, that in Schiedam alone, in 1875, the spirits distilled amounted to 9,212,631 gallons; the grain and malt mills supplying 53,001,245 lbs. of rye meal, and 46,628,865 lbs. of malt. Other distilleries are scattered about the country. Notwithstanding this immense manufacture of alcohol, the Dutch are by no means an intemperate people; the fact is, the larger part by far of the spirit made in Holland is exported to other countries, especially to North America and Northern Europe. It was formerly always exported in bottles, but casks are now much used as well. The chief manufactories of gin in England are those of Messrs. Booth and Messrs. Smith and Nicholson, in London; Messrs. Coates and Co., at Plymouth; and one or two large distilleries in Bristol.

Perhaps nothing used as diet by man is liable to greater and more injurious adulteration than gin. Almost every gin-shop keeper in London has some vile recipe for increasing the pungency and giving a factitious strength to the much diluted sweetened spirit sold under this name. A mere enumeration of the articles usually employed will give some idea of the extent to which sophistication is carried on with this spirit: Roach alum, salt of tartar (carbonate of potash), oils of juniper, cassia, nutmeg, lemons, sweet fennel, and caraway; coriander seeds, cardamoms, and capsicums; and worse than all, creosote, which is most injurious. It is said that sulphuric acid is even added, but this requires confirmation.

GINCKELL, GODART VAN, 1640–1703; first earl of Athlone. He was the head of an ancient and noble family, and bore the title of Baron van Reede. In his youth, he entered the Dutch army, and in 1688 he followed William, prince of Orange, in his expeditions to England. In the following year he distinguished himself by a memorable exploit—the pursuit, defeat, and capture of the Scottish regiment which had mutinied at

Ipswich, and was marching across the fens to their native land. It was the alarm excited by this mutiny that facilitated the passing of the first mutiny act. In 1690, Ginckell accompanied William III. to Ireland, and commanded a body of Dutch cavalry at the battle of the Boyne. On the king's return to England, gen. Ginckell was entrusted with the conduct of the war. Among those who held command under him was the marquis of Ruvigny, the recognized chief of the Huguenot refugees. Early in June, Ginckell took the fortress of Ballymore, capturing the whole garrison of 1000 men. The English lost only 8 men. After reconstructing the fortifications of Ballymore, the army marched to Athlone, then one of the most important of the fortified towns of Ireland. The Irish defenders of the place were commanded by a distinguished French gen., Saint-Ruth. The firing began on June 19th, and on the 30th the town was stormed, the Irish army retreating towards Galway, and taking up their position at Aghrim. Having strengthened the fortifications of Athlone and left a garrison there, Ginckell led the English, on July 12th, to Aghrim. An immediate attack was resolved on, and after a severe and at one time doubtful contest, the crisis was precipitated by the fall of Saint-Ruth, and the disorganized Irish were defeated and fled. A horrible slaughter of the Irish followed the struggle, and 4,000 corpses were left unburied on the field, besides a multitude of others, that lay along the line of the retreat. Galway next capitulated, its garrison being allowed to retire to Limerick. There the viceroy, Tyrconnel, was in command of a large force, but his sudden death in Aug. left the command in the hands of gen. Sarsfield and the Frenchman D'Usson. The English army came in sight of the town on the day of Tyrconnel's death, and the bombardment was immediately begun. Ginckell, by a bold device, crossed the Shannon and captured the camp of the Irish cavalry. A few days later he stormed the fort on Thomond bridge, and after difficult negotiations a capitulation was signed, the terms of which were divided into a civil and military treaty. Thus was completed the conquest or pacification of Ireland, and the services of the Dutch general were amply recognized and rewarded. He received the formal thanks of the house of commons, and was created by the king, first earl of Athlone and baron of Aghrim. The immense forfeited estates of the earl of Limerick were given to him, but the grant was a few years later revoked by the English parliament. The earl continued to serve in the English army, and accompanied the king to the continent in 1693. He fought at Landen, and assisted in destroying the French magazine at Givet. In 1702, he took command of the Dutch, serving under the duke of Marlborough. He died at Utrecht, Feb. 10, 1703. On the death of the ninth earl without issue, in 1844, the title became extinct. [*Encyc. Brit.* 9th ed.]

GI'NGAL, a weapon used by Asiatic armies in the defense of fortresses. It may be described as a large and rude musket, which is fired from a rest. The Chinese employ it to a considerable extent.

GI'NGEE is one of the Virgin islands—the group at the n.e. bend of the grand arch of the West Indies.

GINGER (*Zingiber*), a genus of plants of the natural order *scitamineæ* or *zingiberaceæ*, having the inner limb of the perianth destitute of lateral inner lobes, and the fertile stamen prolonged beyond the anther into an awl-shaped horn. The species are perennial herbaceous plants, with annual stems, and creeping root-stocks (*rhizomes*); the stems produce leaves in two opposite rows; the flowers are in compact spikes with bracts. They are natives of the East Indies. The root-stocks of most of the species are used as a condiment and in medicine. The most valuable and generally used are those of the COMMON GINGER (*zangiber officinale*), sometimes distinguished as the narrow-leaved ginger, which has been cultivated in the East Indies from time immemorial, and is now also cultivated in other tropical countries, particularly the West Indies and Sierra Leone, from both of which, as well as from the East Indies, its root-stocks—the ginger of commerce—are a cosiderable article of export. The root-stock is about the thickness of a man's finger, knotty, fibrous, and fleshy when fresh. The stems which it sends up are reed-like, invested with the smooth sheaths of the leaves, generally 3 or 4 ft. high. The leaves are linear-lanceolate and smooth. The flowers are not produced on the leafy stems, but on the short leafless stems (scapes), in spikes about the size of a man's thumb, and are of a whitish color, the lip streaked with purple. The cultivation of ginger is extremely easy wherever the climate is suitable. In India it is carried on to an elevation of 4,000 or 5,000 ft. on the Himalayas, in moist situations. The root-stock is taken up when the stems have withered, and is prepared for the market either by seething and scalding in boiling water—in order to kill it—and subsequent drying, or by scraping and washing. The first method yields *black ginger*, the second *white ginger;* the blackest of black ginger, however, being only of a stone color, and the whitest of white ginger very far from perfectly white, unless bleaching by chloride of lime be afterwards employed, as it not unfrequently is, to improve its appearance, a process not otherwise advantageous. There is a considerable difference, however, in the original color of the root-stock in the ginger of different countries, which is supposed to be owing to difference in the varieties cultivated. The uses of ginger both in medicine, as a stimulant and carminative, and in domestic economy, as a condiment, are too well known to require particular notice. Its qualities depend very

much on a pale yellow volatile oil, lighter than water, called *oil of ginger.* It contains also a considerable quantity of starch.—*Candied ginger*, or *preserved ginger*, consists of the young root-stocks preserved in sugar, and is now imported in considerable quantity from China, as well as from the East Indies and from the West Indies. It is a delicious sweetmeat, and is useful also as a stomachic.—*Essence of ginger*, much used for flavoring, is in reality a tincture, prepared of ginger and alcohol.—*Sirup of ginger* is used chiefly by druggists for flavoring.—*Ginger tea* is a domestic remedy very useful in cases of flatulence, and is an infusion of ginger in boiling water.—*Ginger-beer* (q.v.) is a well-known beverage, flavored with ginger.—*Ginger wine* (q.v.) is a cheap liquor flavored with ginger.—Ginger was known to the Romans, and is said by Pliny to have been brought from Arabia.—Another species of ginger is ZERUMBET (*zingiber zerumbet*), also called broad-leaved ginger, cultivated in Java, and of which the root-stock is sometimes erroneously called round zedoary. The root-stock is much thicker than that of common ginger, and is less pungent.—The root-stock of the CASSUMUNAR (*zingiber cassumunar*), sometimes called yellow zedoary, has a camphor-like smell, and a bitter aromatic taste. It acquired a high reputation as a medicine in England and throughout Europe about the close of the 17th c., but having been extolled not merely as a stimulant and stomachic, but as possessing virtues which did not in reality belong to it, it soon sunk into oblivion.—The root-stock of the MIOGA (*zingiber mioga*) is less pungent than ginger, and is much used in Japan.—Cattle sent to graze in the jungles of Northern India, during the rainy season, are supplied with the root-stocks of a species of ginger (*zingiber capitatum*), to preserve their health.—The root of *Aristolochia* (q.v.) *Canadense* is sometimes called *Indian ginger* or *wild ginger* in North America, and is used as a substitute for ginger. It has a grateful aromatic odor and taste, and is stimulant, tonic, and diaphoretic.

GINGER-BEER. An effervescing drink made by fermenting ginger, sugar, and some other ingredients, and bottling before the fermentation is completed. The following recipes are amongst the best known: Lump sugar, 5 lbs.; crushed Jamaica ginger (the unbleached is best), 5 oz.; cream of tartar, 4 oz.; 10 lemons, sliced; and 5 gallons of boiling water. They should be mixed in a vessel which can be kept covered until cool, but require stirring from time to time as the cooling goes on. When lukewarm, add 10 oz. of yeast, and keep it in a warm place to encourage the fermentation, which soon commences; after one day's fermentation, strain through a flannel filter, and let it stand to ferment again for a short time; then take off the scum, and bottle. The bottle must be tied or wired down. Another recipe is: Cream of tartar, 8 oz.; ginger, 1 oz.; refined sugar, 1¼ lbs.; 1 sliced lemon, 1½ gallons boiling water; 1 oz. yeast; to be treated in the same way. A spurious ginger-beer, largely used, is made by putting a few drops of tincture of ginger and a little syrup in a bottle, and filling it up with aërated water from the soda-water machine.

GIN'GERBREAD. A very well-known article of food, which has been in vogue certainly since the 14th c., when it was made and sold in Paris, according to Monteil in his *Histoire des Francais* (tom. ii. pp. 47, 48); it was then made of rye dough, kneaded with ginger and other spice, and honey or sugar. It was probably introduced into England by the court of Henry IV., and since that time has played an important part in the pleasures of young and old at the fairs and festivals of the country. Changes were, no doubt, wrought in its composition as soon as it appeared in this country, and the expensive honey gave way to the cheaper treacle which was then in use, and the color was hidden under some coloring matter or gilding. "To take the gilt off the gingerbread," has become a proverb, and the booths glittering with their gilded array of rude devices in gingerbread, so familiar to our boyhood, still make an occasional appearance in the country fairs.

Three forms of this article are to be found in most pastry-cooks' shops, and one or more of them in the sanctum of every good housewife. 1. Square soft cakes, from 2 to 3 inch. in thickness. 2. Thin cakes of various forms, but most frequently round, being stamped out with the top of a wine-glass, or other contrivance. 3. Small button-like cakes, called gingerbread-nuts. The two last should be baked very quickly, crispness being indispensable. The constituents of modern gingerbread are treacle, moist sugar, wheaten-flour, and butter; a little carbonate of magnesia and tartaric acid, or carbonate of ammonia, are also put in to give lightness by many makers.

GINGER-WINE, a popular and cheap liquor, made by the fermentation of sugar and water, and flavored with various substances, but chiefly with ginger. It is partly an article of domestic manufacture, and is partly made on a larger scale for sale. It may be made by dissolving about 6 lbs. of sugar in 14 galls. of water; adding 4 oz. of bruised ginger and the whites of two eggs, well beaten; mixing thoroughly; boiling for a quarter of an hour; skimming carefully; and when the liquor has cooled, adding the juice of four lemons, and also their rinds for flavoring, with a tea-cupful of ale-yeast to promote fermentation; letting it ferment in an open vessel for twenty-four hours, and then putting it into a cask of suitable size, closely bunged, in which it remains for a fortnight before it is bottled. It is, however, very common to increase the strength of ginger-wine by the addition of spirits, the flavor being also modified by the kind of spirits employed. A little spirits added makes ginger-wine

keep well, and it even improves in quality for many months. Its quality depends much on that of the sugar and of the ginger employed, and also on the care with which the manufacture is conducted.

GING'HAM. A cotton fabric originally introduced with its present name from India; it is now manufactured to an immense extent in Britain, and our manufacturers supply, to a very great extent, the Indian markets. It differs from calico in the circumstance, that its colors are woven in and not afterwards printed. At first, the Indian ginghams consisted of cotton cloths, with two or more colors arranged as a small checkered pattern; now, a great variety of designs are found in this material, and in the case of umbrella ginghams, the whole piece is woven with yarn of one color. The following are the chief kinds of gingham known in the markets of Great Britain: plain common light grounds; plain common dark grounds; Earlston ginghams; power-loom seersuckers and checks (imitations of the Indian patterns); muslin ground (stripes and checks): furniture stripes and checks; colored diapers; crossover stripes; derries, Hungarians; jean stripes, and umbrella ginghams.

GIN'GILIE OIL, a name often given to the bland fixed oil obtained by expression from the seeds of *Sesamum Indicum*. See SESAMUM.

GINGKO, or GINKO (*Salisburia adiantifolia*), a large tree of the natural order *Taxaceæ* (yew, etc.), with straight erect trunk and conical head, and leaves remarkably resembling the leaflets of the fronds of maidenhair, somewhat triangular, cloven and notched at the upper extremity, shortly stalked, leathery, smooth, shining, yellowish green, with numerous minute parallel ribs, and somewhat thickened margins. The fruit is a sort of drupe, of which the fleshy part is formed by the persistent calyx, about an inch in diameter; the nut or endocarp white, a thin shell with a farinaceous kernel resembling an almond in flavor, with a little mixture of austerity. The tree is a native of China, but has been long known in Europe, and large trees are now to be seen in England. The wood is easy to work, receives a fine polish, is yellowish white, veined, and not resinous. In China and Japan, the gingko is grown chiefly for the kernel, which is freed from austerity by boiling and roasting. The fleshy part of the fruit, although resinous and astringent, is also eaten after being slightly roasted. The male and female flowers are on different trees, but the Chinese plant several close together, which grow into a monstrous tree, producing both male and female flowers.

GINGRAS, a co. in n.e. Dakotah not included in the census of 1870. Its area is about 1500 sq.m. The Dakotah river has its rise here, a branch of the Cheyenne flows through the county.

GINGUENÉ, PIERRE LOUIS, 1748–1815; b. at Rennes, in Brittany. He was a voluminous writer and controversialist. As director-general of the commission of public instruction, he aided greatly in the reorganization of popular education. He was a member of the institute, and in 1798 was appointed by the directory minister plenipotentiary to the king of Sardinia. He contributed to the literary history of France (Benedictines), and wrote the *Histoire Litteraire d'Italie*, upon which his reputation chiefly rests. This work was surprisingly successful, numerous editions being published, besides three translations into Italian.

GINNUNGA GAP. See BURE.

GINSENG, a root highly esteemed in China as a medicine, being universally regarded as possessing the most extraordinary virtues, and as a remedy for almost all diseases, but particularly for exhaustion of body or mind. It is sometimes sold for its weight in gold. It was once introduced into Europe, but soon forgotten. It is the root of a species of *Panax*, of the natural order *Araliaceæ*, to which the name *P. ginseng* has been given, and which is a native of Chinese Tartary; having a stem from 1 to 2 ft. high; leaves on long stalks, five-fingered, and almost quite smooth; and umbels on a long terminal stalk. It is doubted by many botanists if this species is really distinct from *P. quinquefolium*, a common North American plant; the root of which is now an article of export from North America to China, and is used as a domestic medicine in the states w. of the Alleghanies, but which European and American medical practitioners generally regard as almost worthless. It is mucilaginous, sweetish, and slightly bitter and aromatic.—*P. fruticosus* and *P. cochleatus* are fragrant aromatics, growing in the Moluccas, and used by the native practitioners of India.—The fruit of the genus *Panax* is succulent, compressed, with two or three leathery one-seeded cells.

GIOBER'TI, VINCENZO, a remarkable Italian writer and thinker of modern times, was b. in 1801, at Turin. He was educated for the church, obtained his degree of doctor of theology in 1823, and was ordained to the priesthood in 1825. He was subsequently appointed professor of theology in the university of his native city, and on the accession of Charles Albert, was selected as chaplain to the court, an office which he filled with distinction till 1833. At this period of rising political agitation, Gioberti was accused of promoting the liberal movement, was dismissed from court, and suffered an imprisonment of four months. Having obtained permission to retire into banishment, he went first to Paris, and shortly after to Brussels, where he spent eleven years as private tutor in an academy, pursuing in his leisure hours his private studies. A devout Catholic, Gioberti looked upon the papacy as the divinely appointed agency for

the elevation of Italy among the nations. A confederation of states subject to papal arbitration, and having in the king of Piedmont a military protector, was the scheme devised by Gioberti for the unity and regeneration of his country. In short, in the 19th c. he advocated the Guelph policy of the middle ages. These views he elaborately developed in his work entitled, *Il Primato Civile e Morale degli Italiani* (The Civil and Moral Supremacy of the Italians). Its publication in Paris, in 1842, during the author's exile, was hailed with the utmost enthusiasm by Italy, with the exception of a limited and far-sighted section of the country. The liberal and conciliative policy adopted by Rome on the accession of Pius IX., appeared the verification of Gioberti's predictions, and increased the popularity of his name. On his return to Italy, he was received with universal ovations from all classes of the people, and was honored by being chosen by several towns as their representative in parliament. The king appointed him senator, he subsequently was elected president of the chamber of deputies, and finally prime minister; owing to the great divergence of opinion which divided his ministry, he held office only for a few weeks, and was forced to resign. His successor dispatched him to Paris on some unimportant mission, in order it was thought to remove him from Turin; and thus ended Gioberti's political career, as from that period he filled no official position, but devoted himself exclusively to literary pursuits. As a politician, Gioberti failed in far-sightedness; and with the course of events in Italy, his influence as a political guide inevitably declined; but the depth and range of thought and strength of conviction evinced in his various works, entitle him to the consideration and standing which, as a writer, he enjoys. Gioberti's remarkable gentleness in private intercourse bore no trace of the energetic force with which his writings propound an opinion or denounce an opponent. He died at Paris of apoplexy in 1853. His chief writings are entitled, *Introduzione allo studio della Filosofia* (Paris, 1839); *Il Primato* (Paris, 1842); *Il Gesuita moderno*, 8 vols. (Lausanne, 1847); *Il Rinnovamento civile degli Italiani* (Paris, 1851).

GIOBERTI, VINCENZO (*ante*), 1801-52, an Italian statesman and philosopher, the great object of whose life was the deliverance of his country. This, in his conception of it, included emancipation not only from foreign armed force, but also from foreign modes of thought, which were contrary to its genius and destructive to its authority in European affairs. That authority he regarded as connected with the supremacy of the papacy—its intellectual and moral supremacy, rather than its political domination. This distinction must be kept in mind by all who would understand either the writings of Gioberti or his life. In order to commend the priests to popular regard, he advised them to put themselves at the head of the social movement, introduce needed reforms and diffuse instruction. He also called on the educated men of Italy to regain their former ascendency by uniting faith with knowledge. With this object in view he wrote his remarkable work on the civil and moral supremacy of Italy, in which he considers civilization as vitally connected with religion. The substance of the book is: "Italy has been twice at the head of European civilization; once in ancient times, and again in the middle ages. In the latter period it owed its position to the popes, who were then the natural arbiters of princes and the spiritual sovereigns of the nations. The downfall of Italy is due to the downfall of the papacy. The problem now is to restore the papal power, as a *moral dominion* based on religion and public opinion." In his most important work, *The introduction to philosophy*, Gioberti teaches "that the source of all human knowledge is in God, that it is one whole and, in a manner, identical with God himself." The name which he gives it is, The Idea or Thought. "This is communicated to man in proportion as he is capable of receiving it, and is 'the light which enlighteneth every man that cometh into the world.' Man receives it by his reason, which is capable of directly beholding it, and this intuition of the idea is the origin and first cause of all the knowledge of natural things which the mind of man possesses. It rises *to* the mind at the same moment as the thought which apprehends it; yet it does not rise *within* the mind, but enters it from without. It is the principle of knowledge to the human mind, from the very first exercise of its powers as a thinking being. Yet this direct intuition of the divine thought by the reason, although the origin of all thoughts in the soul, is by itself imperfect. In order to render it available it must be reflected on; and in order to reflection language is necessary. For this purpose language was given, by means of which God originally reveals to man that which he had caused him to behold by direct intuition, and by means of which also this same revelation is repeated and carried on from generation to generation. Yet language is not the cause of human knowledge; nor is it, in the case of ordinary knowledge, the medium of the exhibition of the divine thought to the mind (for that shines immediately on the mind) but it is the occasion of its being completely revealed. For the purposes of ordinary and natural knowledge the combination of intuition with language is the method ordained; but *supernatural knowledge* can be conveyed only by means of language, and divine truths are not seen by intuition but are *believed*. Yet all knowledge, of every kind, has its source in the divine thought, and consists of such views of it as the individual is capable of. Besides reason, which is capable of beholding the divine thought, man has internal and spiritual feelings that are modifications of the mind and are preserved by feeling, and material and external feelings, that have reference to the properties of

bodies and are perceived by sensation and the outward senses. The ordinary range of modern metaphysics is confined to these internal and external feelings; and it is a common error to substitute the internal feeling as a first principle instead of that which is apprehended by the reason through direct intuition and revealed to the soul by language and reflection. It is an equally common error to substitute reflection on the internal and external feelings for reason as the initiatory instrument of that knowledge which is the basis of philosophy. But it is by the intuition of the divine thought that meaning is imparted to these various feelings, external and internal, and to the various sensible objects by which they are surrounded. The basis of all knowledge is the knowledge of *being*, yet not of its abstract idea but of the personal Being, God himself acting as a cause and producing *existences*. He is in fact the only being, because he alone has being in himself. The knowledge of this Being is gained by revelation through the written word, wherein he declares himself, "*I am that I am;*" and the mind beholds him and has him made known to it internally through the reason, independently of all external sensations. God being the only Being, all other things are only existences; and man learns from the revealed word that the One being creates existences; not that he extends himself into these various manifestations, as Hegel says, not that he causes them to emanate from himself, as other pantheists say, but that he *creates* them. Man thus learns that they are individual, real things, having a kind of personality; that the act of creation gives them this reality and individuality; and that nothing but the act of creation could assure to him the reality of external things. All knowledge of philosophy must begin with a knowledge of beings and existences and of their relation to each other; and that, not of abstract being and existences, but of one concrete Being and of many concrete individual existences. And a knowledge of these latter the divine thought gives to man by a direct view of them which imparts life and meaning to all his sensations and feelings in connection with them. The principles of knowledge are objective, eternal and absolute; not the creation of the mind, nor sought out by it, but presenting themselves to it, unsought, as first truths—the foundation of other truths. The permanent possession by man of the divine thought depends, in a measure, on himself; he may consent to it and obey it and thus secure it; or may rebel against it and thus lose it. It is by participation of it that individuals possess a moral personality; it is the vital principle, the entire withdrawal of which would result in annihilation. As it creates and governs the universe, it is the soul of the world; as it dwells in the human mind, it is knowledge; as it actuates, produces, determines, and classifies the powers of nature, it is the generic and specific essence of things; and the basis of generality is the divine Being himself, having in himself the ideas of all possible things and the power of giving effect to those ideas."

GIOBERTINE TINCTURE, a preparation for restoring writings or paintings which have from age become illegible. In some cases the process has recovered documents which have been partially expunged, and the parchment written over. (See PALIMPSEST, *ante*). The inventor was Giovanni Antonio Giobert; 1761–1824; a native of Piedmont; secretary of the society of agriculture at Turin, and professor in the university in that city.

GIOCONDO, or JOCUNDUS, FRA GIOVANNI, 1450–1530; a native of Verona. He was a Dominican friar, studied archæology in Rome, and made a remarkable collection of ancient inscriptions which he presented to Lorenzo di Medici. He was the designer of the fortifications of Treviso, and of works which saved Venice from inundation. He was architect to the emperor Maximilian, and was employed by Louis XII. in building the bridges of Notre Dame and the Hotel Dieu. In Venice, he built a great warehouse which was decorated by Titian and Giorgione. The pope appointed him to succeed Bramante as the architect of St. Peter's, and he was there a co-laborer with Raphael. He was proficient in philosophy, theology, and classical literature, and wrote notes on Cæsar's *Commentaries*.

GIO'JA, the name of four towns of the s. of Italy. The most important (Gioja del Colle) is in the province of Bari, 26 m. s. of Bari. It is a thriving, industrious place, surrounded by a fine fertile territory. Pop. '71, 13,094. It was formerly famous for the beauty of its woods, the favorite hunting-grounds of the emperor Frederic II.

The second town is in the province of Reggio (Calabria), situated a mile from the sea, and 28 m. n.e. of Reggio. It is said to be of ancient origin, and has sustained several severe sieges. It was finally all but destroyed in 1783 by an earthquake, and now possesses only about 1000 inhabitants.—The third Gioja is in the province of Aquila, 34 m. s.s.e. of Aquila, and 60 from the sea, with 2,409 inhabitants. Its territory, although mountainous, is productive.—The fourth is a town of 1560 inhabitants, in the province of Caserta, 6 m. n.w. of Cerreto.

GIOJA, MELCHIORRE, a famous Italian statistician, was b. at Piacenza, Sept. 20, 1767. He was educated for the priesthood, and for sometime discharged the duties of tutor in a noble family, but through the liberality of his brother, was enabled to resign this post, and to follow his own bent, which was towards social and economic science. When the invading forces of France descended into Italy, Gioja had already attracted much notice by his political writings; and in 1797, he quitted Piacenza for Milan, and was there appointed state historiographer, a post he was deprived of in 1803, in consequence

of his work on divorce giving great dissatisfaction. In 1806, he was appointed director of the statistical department, and in 1809, the minister Vaccari intrusted to him the preparation of a grand statistical report of all Italy. This great labor was still in progress when a change of government interrupted it. Gioja died at Milan, Jan. 2, 1829. His laborious habits and immense knowledge of the subjects he wrote upon, enabled him to accomplish an incredible amount of labor, but he is justly blamed for the bitter strain of personal invective with which he resented the least unfavorable criticism of his works. Some of his chief works are: *Sul Commercio de' Commestibili e caro prezzo del vitto* (Milan, 1802, 2 vols. in 12mo); *Teoria civile e penale del divorzio ossia necessità, cause nuova maniera di organizzarla* (Milan, 1803, in 8vo); *Nuovo prospetto delle scienze economiche, ossia somma totale delle idea teoriche e pratiche in ogni ramo d'amministrazione privata e pubblica* (Milan, 1815–19, 6 vols. in 4to); *Filosofia della Statistica* (Milan. 1826, 2 vols. in 4to); *Dell' ingiuria, dei danni, del soddisfaci mento e relative basi di stima* (Milan, 1802, 2 vols. in 8vo).

GIOJO'SA, a t. of southern Italy, in the province of Reggio, is situated about 7 m. n.e. of Gerace, in a fertile and beautiful district. and is supposed to have risen on the ruins of the ancient city of Mitra, mentioned by Pliny. Its air is remarkable for purity, and its inhabitants for physical vigor and beauty. Pop. '71, 5,488.

GIORDA'NO, LUCA, an Italian painter, was b. of impoverished parents at Naples, about 1632; studied under Ribrera or Spagnoletto, and made rapid progress. Singularly enough, considering his fine imagination and delicate touch, both his early productions as well as those of his more mature years, indicate rather a power of beautifully correct imitation than any marked originality or elevation of genius. On leaving Ribrera's school, Giordano repaired to Rome, where he became the scholar and fellow-worker of Pietro da Cortona. Subsequently, he went to Lombardy and Venice, to familiarize himself with the styles of the schools of art there. After some time he proceeded to Madrid, in 1692, at the request of Charles II., king of Spain, who desired his assistance in the embellishment of the escorial. His pleasing freedom of manner and genial humor rendered him a special favorite during his residence at the Spanish court, which he only quitted for Italy on the death of the king, 10 years later. The extreme rapidity of execution for which Giordano was remarkable, enabled him to produce a prodigious number of works, but undoubtedly told detrimentally against their excellence. With some blemishes, they possess, however, many beauties, and are chiefly admired for their spirited animation of character, and harmonious freedom of treatment, they also excel in boldness and perfection of the foreshortening. The palaces Riccardi and Petti contain some fine specimens of this artist's style, but his best paintings are in the galleries of Dresden and Naples, and the escorial at Madrid. Giordano died about 1704. The name of *Fa presto*, which distinguished him through life, referred to his father's incessant injunction to *work quickly*, in order that the proceeds of his labor might relieve the indigence of the family.

GIORGIO'NE, or GIORGIO BARBARELLI, one of the most poetical and fascinating of Italian painters, was b. about 1478 at Castelfranco, in the Venetian territory of Trevisano. He studied under Giovanni Bellini, but quickly surpassed his master, for while Bellini's style is distinguished for its minute finish and cramped precision, that of Giorgione literally revels in freedom and breadth of outline, and gorgeous depth of color. Unfortunately for art, Giorgione died in 1511, at the early age of 33. His works are of course limited in number, but they are among the most rare and exquisite examples of the Venetian school. Scriptural scenes, highly original in idea and treatment, portraits, and a few sweet idyllic scenes, representing pastoral concerts and sylvan enjoyments, form the subjects of these pictures, which all glow with the fine imagination, the rich coloring, and the energy of touch, that are Giorgione's distinctive attributes. The Lombard galleries and the Louvre possess the best authenticated originals of Giorgione, whose imitators were numerous.

GIOTTINO, TOMMASO DI STEFANO, 1324–57; a Florentine painter to whom are attributed the frescos in the chapel of the Florentine church of San Croce representing the miracles of poor St. Sylvester as narrated in the *Golden Legend*. A large number of works have been attributed to the same hand. He has been particularly praised for well-blended chiaroscuro.

GIOT'TO, or AMBROGIOTTO BORDONE, a great painter, architect, and sculptor, b. in 1276, was the son of a poor shepherd, and passed the earliest years of his life in watching flocks in his native Tuscan valley of Vespignano. Here he first essayed to reproduce on a fragment of slate the forms of nature surrounding him, and to the subtle influences of these early associations may be ascribed much of the devotion which Giotto's perfected works evince towards nature in her purest and most winning aspects. One of these simple designs, representing a sheep, having fallen under the notice of Cimabue, the latter became interested in Giotto, and having obtained the consent of the youth's father, received him into his studio. Giotto's intuitive perception of the *true* in art speedily emancipated him from the conventionalities, although it is true that Cimabue himself had previously taken steps in this direction. In Giotto's paintings, however, we first markedly observe, instead of the flat elongated forms and lifeless features of the Byzantine types, figures imbued with the varied action and expression of nature, and

exhibiting besides an ideal elevation and grandeur of character. He first also practiced the art of grouping with due regard to the sentiment and action of the composition, and gave simplicity and grace to the draping outline; in short, he effected a profound reformation in the style of art, which from his era assumed its rightful alliance with the beautiful in nature. Giotto was also an eminent architect, and was employed in the execution of the dome of Florence, while from his designs the Campanile (q.v.) was built. The beloved friend of Dante, and of all the great souls of his age, he himself presented a rare union of genius, knowledge, and wit, combined with the utmost equanimity of humor and massive good sense. The restorer of portraiture, his pencil has transmitted to our day the features and personality of his cherished Dante, of Brunetto Latini, Corso Donati, and other celebrities; and in return we find his name enshrined with reverence in all the grand literary works of the times, especially in those of Dante, Boccaccio, and Petrarca. The works of this illustrious man are too numerous to be recorded here, but we may mention some of the principal. "The Coronation of the Virgin," in the church of Santa Croce at Florence; "A Last Supper," in the refectory; the famous mosaic, executed at Rome for pope Boniface VIII., named "La Navicella," and representing Peter walking on the waves; a wonderful work, which has unhappily severely suffered in the successive repairs it has required; the frescos of the "Seven Sacraments," painted at Naples in the church of the Incoronata, one of the most perfect of his works in point of preservation; and the frescos of Assisi, illustrating the life of St. Francis, and innumerable other minor works. Giotto died at Florence in 1336, and was interred in the church of Santa Maria de Fiore, where a marble monument was erected to his honor by Lorenzo de' Medici.

GIOVAN'NI (San) **A TEDUCCIO**, a t. of 11,000 inhabitants, 3 m. e. of Naples, is situated near the sea-shore in a fertile plain. Its neighborhood is well cultivated, and embellished with beautiful villas. Its origin is supposed to be very ancient, and its name is attributed to the emperor Theodosius, whose name is carved on a small ancient column discovered in the vicinity of the town.

GIOVAN'NI (San) **IN FIO'RE**, a t. of s. Italy, in the province and 24 m. e. of the town of Cosenza, is situated at the confluence of the Neto and Arvo, in the Sila forest. Pop. 9,500.

GIOVANNI (San) **ROTONDO**, a t. of s. Italy, in the province of Foggia, and 19 m. n.e. of the town of that name, near Mt. Gargana. There are manufactures of linen and woolen fabrics. Pop. '71, 7,745.

GIOVENAZ'ZO, a thriving little t. in the s. of Italy, province of Bari, is situated on the shore of the Adriatic, 14 m. w.n.w. of the town of Bari. It is considered the Natiolum of the Romans, and possesses some remains of its ancient walls. In the 11th c. it belonged to the Greeks, and eventually passed into the possession of the Gonzaga family. There is here an excellently organized asylum for the poor, conjoined with extensive juvenile reformatories. Giovenazzo is encircled by vineyards and rich plantations of olive, almond, and other fruit-bearing trees. Pop. '71, 9,108.

GIOVIO, Paolo, 1483-1552; b. Italy; educated at Pavia. He began the study of medicine, but soon left it for that of history. Under papal and royal protection he was granted many honors, chiefly for the work of a free-lance, fighting without principle or conscience for the best paying employers. When the constable of Bourbon plundered Rome he was stripped of his property, but he was immediately consoled with the bishopric of Nocera. *The History of His Own Time*, is his most important work, but it is untrustworthy.

GIPSIES. See Gypsies.

GIRAFFE, or Camelopard (*Camelopardalis Giraffa*), the tallest of quadrupeds, ranked by some naturalists among deer (*cervidæ*), but more properly regarded as constituting a distinct family of ruminants, which contains, however, only one species. It is a native of Africa, from Nubia to the cape of Good Hope, extensively diffused, but apparently nowhere abundant. It occurs generally in small herds of from five to forty. It feeds on the leaves and small branches of trees. Its general aspect is remarkable from the height of the foreparts and great elongation of the neck, the head being sometimes 18 ft. from the ground. The number of vertebræ in the neck, however, is not greater than in other quadrupeds, and it has no extraordinary flexibility, although its form and movements are very graceful. The body is short, and the back slopes from the shoulder to the tail; but the greater height of the foreparts is not owing, as has been often alleged, to the greater length of the forelegs, which are not really longer than the hindlegs, but to processes of the vertebræ, which form a basis for the muscular support of the neck and head. The articulation of the skull to the neck is such that the head can be easily thrown back until it is in the same line with the neck, thus giving the animal additional power of reaching its appropriate food. The skull has empty cavities, which give lightness to the head, along with sufficient extent of surface for the insertion of the ligament which supports it. The legs are long and slender; the feet have cloven hoofs, but are destitute of the small lateral toes or spurious hoofs, which occur in the other cloven-footed ruminants. The head is long; the upper lip entire, projecting far beyond the nostrils, and endowed with considerable muscular power. The tongue is

remarkably capable of elongation, and is an organ of touch and of prehension, like the trunk of an elephant; it can be thrust far out of the mouth, and employed to grasp and take up even very small objects; it is said that its tip can be so tapered as to enter the ring of a very small key. The usefulness of such an organ for drawing in leaves and branchlets to the mouth is obvious. The giraffe adroitly picks off the leaves of acacias and other thorny plants, without taking the thorns into its mouth. The dentition of the giraffe agrees with that of antelopes, sheep, goats, and oxen; the upper jaw of the male is destitute of the canine teeth, which are present in the male of most kinds of deer. The head is furnished with two remarkable protuberances between the ears, generally described as horns, but very different from the horns of other animals, and each consisting of a bone united to the skull by an obvious suture, permanent, covered with skin and hair, and terminated by long hard bristles. There is also a projection on the forehead. The ears are moderately long: the tail is long, and terminates in a tuft of long hair that nearly reaches the ground. There is a callosity on the breast. The neck has a very short mane. The hair is short and smooth; the color is a reddish white, marked by numerous dark rusty spots. The eye of the giraffe is very large and lustrous, and so placed that the animal can look all around without turning its head, so that in a wild state it is not easily approached. Its nostrils have a muscle by which they can be closed; a provision, as Owen supposes, for excluding particles of sand. It is an inoffensive animal, and generally seeks safety, if possible, in flight, although it is capable of making a stout resistance, and is said to beat off the lion. It fights by kicking with its hind-legs, discharging a storm of kicks with extraordinary rapidity. It is not easily overtaken even by a fleet horse, and has greatly the advantage of a horse on uneven and broken ground. Its pace is described as an amble, the legs of the same side moving at the same time. The giraffe was known to the ancients, and was exhibited in Roman spectacles. Representations of it appear among Egyptian antiquities. It has been supposed to be the *zemer* of the Jews, translated *chamois* in the English Bible (Deut. xiv. 5). In the year 1836, giraffes were added to the collection in the zoological gardens of London, and interesting opportunities of studying their habits have since been enjoyed. They are fed chiefly on hay placed in high racks, greatly enjoy carrots and onions, and a lump of sugar is a favorite delicacy. They have bred in England. The flesh of the giraffe is said to be pleasant, and its marrow is a favorite African delicacy.

GIRAL'DUS CAMBREN'SIS, the literary name of Gerald de Barri. He was fourth son of William de Barri, a Norman noble who had settled in Pembrokeshire, and allied himself by marriage to the family Rhys ap Theodore, prince of South Wales. Giraldus was born about 1146, and educated by his uncle David, who was bishop of St. David's. He entered the university of Paris in his 20th year, and after three years of much literary distinction he returned to England, entered into holy orders in 1172, and was soon afterwards appointed archdeacon of St. David's. He was from the first a zealous churchman; strenuous in the enforcement of discipline, and especially of clerical celibacy; and was the chief agent in the establishment of the payment of tithes within the principality. On the death of his uncle, the chapter of St. David's elected him bishop; but as the election was made without the royal license, Giraldus renounced it. The king, Henry II., directed a new election; and on the chapter's persisting in their choice of Giraldus, the king refused to confirm the selection, and another bishop, Peter de Leia, was appointed. Giraldus withdrew for a time to his old residence in the university of Paris, and on his return he was required, by the archbishop of Canterbury, to take the administration of the diocese of St. David's, which had utterly failed in the hands of De Leia. He held it for four years, when being appointed a royal chaplain, and afterwards preceptor to prince John, he accompanied that prince in 1185 in his expedition to Ireland, where he remained after John's return, in order to complete the well known descriptive account of that country, which, although very valuable as a whole, has in many of its details called forth much angry criticism from Irish scholars and antiquaries. On his return, in 1187, he read this work publicly in the university at Oxford, giving a full day to each of the three divisions of which it consists. A tour of Wales which he made (1188) in the company of Baldwin, archbishop of Canterbury, led to a similar descriptive work, the *Itinerarium Cambriæ*. In the following year he accompanied the king to France, where he remained till the king's death. His later years, after his return, were full of disappointment. On the see of St. David's again becoming vacant, he was again unanimously elected by the chapters; but the archbishop of Canterbury having interposed, Giraldus, notwithstanding an appeal to Rome, in prosecuting which he made three different journeys in the course of five years of the contest, failed to obtain a confirmation of the nomination. He soon afterwards resigned his archdeaconry, and devoted the remaining seventeen years of his life to study. Once again the see of St. David's became vacant, but although it was offered to Giraldus on certain conditions, he declined to accept it, and died at St. David's in the 74th year of his age. The reason why Giraldus's appointment to the bishopric was so much opposed is not clearly known, but the king, it is said, had resolved that no native of Wales should obtain the dignity. Giraldus's writings, although disfigured by credulity, and in the personal narratives with which they abound, by excessive vanity, are of great value as materials for the history, and for the social condition of the age and the countries which he describes. But they must be

read with much caution, and with a careful critical consideration of the sources of the information which they embody. Several of his works are still preserved in manuscript in the British museum, the Bodleian, the Lambeth, and Corpus Christi college libraries. His printed works are the *Itinerarium Cambriæ; Topographia Hiberniæ; Expugnatio Hiberniæ; Descriptio Cambriæ;* and several smaller pieces, which are printed in the second volume of Wharton's *Anglia Sacra.* Barry's work on Ireland called out several rejoinders, the most valuable of which is that of John Lynch (under the pseudonym of *Gratianus Lucius*), entitled *Cambrensis Eversus;* a less valuable work is that of Stephen White, recently published, from the original manuscripts; sir James Ware has freely criticised Barry in the *Antiquities of Ireland.*

GIRARD, PHILIPPE HENRI DE, 1775–1845; a French mechanician. In his early life he manifested a strong aptitude for mechanical invention, and he also at that time devoted his attention to botany, painting, and literature. When at the Revolution his family took refuge in Italy he supported himself there for some time by painting, but afterwards, at the age of 18, he established a soap manufactory at Leghorn. Returning to France after the fall of Robespierre, he began to conduct a chemical work at Marseilles, but soon afterwards judged it prudent to go to Nice, where he obtained the professorship of chemistry and of natural history. About 1800, he went to Paris, where, in company with his brother Frederick, he established a soap manufactory. In 1804, he and his brother took out a patent for what is known as the fountain lamp; and at the "exposition" of 1806 he was awarded a gold medal for his one-cylinder direct-acting steam-engine. Napoleon having in 1810 decreed a reward of one million francs to whoever should invent a machine for the spinning of flax equally successful with those in use for the spinning of hemp, Girard, after a course of experiments, invented and patented a flax-spinning machine. In 1813, he established a flax mill at Paris and another at Charonne, in both of which he made use of his machine; but although he was declared to have earned the reward offered for the invention, the fall of Napoleon in 1815 left the decree unfulfilled. Girard, who expected that the expenses connected with his experiments would be met by the promised premium, now got into serious money difficulties, and had to leave France for Austria, where, besides establishing a flax mill at Hirtenberg, he built the first line of steamships on the Danube. In 1825, at the invitation of the emperor Alexander I. of Russia, he went to Poland, where he erected a flax manufactory, round which grew up a village which received the name of Girardow. He was also appointed chief engineer of the mines of Poland. In 1844, he returned to Paris, and exhibited at the "exposition" a large number of inventions, including a machine for combing flax, a machine for making gunlocks, several new improvements in guns, a piano of double octaves, and a new instrument called the tremolophone. For his inventions connected with the manufacture of flax, a gold medal was decreed to him by the jury; and in 1845, the society of inventions awarded him a sum which raised the pension he received from the Russian government to 6,000 francs. Besides the inventions already mentioned, Girard was the author of a large number of others, many of them of considerable importance in connection with various departments of industrial machinery. A pension of 6,000 francs was bestowed in 1857 on his only surviving brother, and another on his niece. [*Encyc. Brit.*, 9th ed.]

GIRARD, STEPHEN, 1750–1831; was b. at Bordeaux, France. At the age of 13 he commenced life as a sailor, and followed his avocation with such assiduity that he was enabled, before the French requisitions of age and service allowed, to become master and capt. in Oct., 1773. His first mercantile venture was to San Domingo in 1774, whence he proceeded in July to the then colony of New York. After trading for three years between New York, New Orleans, and Port au Prince, he went to Philadelphia in May, 1777, and gave up the sea for a mercantile career. While he was engaged most successfully in the prosecution of an extensive trade, the yellow fever in its most malignant type broke out in Philadelphia, sweeping away one-sixth of its population. When, during its height, a hospital was established, for which it seemed almost impossible to secure competent management, Girard devoted himself personally, fearless of all risks, to the care of the sick and the burial of the dead, not only in the hospital, of which he became manager, but throughout the city, supplying the poorer sufferers with money and provisions. Two hundred children made orphans by the ravages of the fever, were in a great measure thrown on his care. From this period his success commercially and financially was unexampled. He gave a portion of his time to the management of municipal affairs for several years, and rendered efficient service as warden of the port and as director of many public institutions. On the dissolution of the bank of the United States he instituted what is known as the Girard bank. During the war of 1812, "he rendered valuable services to the government by placing at its disposal the resources of his bank, at a time of difficulty and embarrassment subscribing to a large loan which the government had vainly sought to obtain." Girard added to his other avocations that of a practical agriculturist. He is chiefly remembered for his magnificent bequest, the foundation of Girard college (q. v.).

GIRARD COLLEGE, an institution in Philadelphia founded by Stephen Girard for the support and education of poor white male children without fathers. The endowment included 45 acres of land and $2,000,000. Boys are admitted between the ages

of 6 and 10, and are to be apprenticed to some industrial occupation when between 14 and 18. According to the will no minister or ecclesiastic of any sect or church was allowed to visit the premises on any pretext, or to have any connection with the institution, and this rule is strictly enforced. The construction of the buildings was commenced in 1833, and finished in 1848. It accommodates 500 boys, who are supported and educated by the institution, there being 20 teachers. The Girard college buildings are 2 m. from Independence hall, Philadelphia (by Ridge ave. cars), and occupy 42 acres of land inclosed by massive stone walls. The main building is considered to be the finest existing specimen of Corinthian architecture. It is built of white marble, 218 by 160 ft. and 97 ft. high, being planned as nearly as possible in accordance the with minute directions left by Girard.

GIRARDIN, EMILE DE, a French journalist and politician, the illegitimate son of the royalist general Alexandre de Girardin and Madame Dupuy, was b. in Switzerland in 1802, educated in Paris, and in 1823 was appointed general secretary of the royal museums. After the July revolution, Girardin established the *Journal des Connaissances utiles*, for which he secured 120,000 subscribers; in 1832, the *Musée des Familles*; and in 1834, the *Almanach de France*. He also published an *Atlas de France* and an *Atlas Universel*. The whole of these publications were set forth as emanating from a *Société Nationale pour l'emancipation intellectuelle*, and were not without a considerable influence on the progress of public instruction in France. In 1836 he founded the *Presse*, as an organ of political conservatism, and soon found himself entangled in violent controversies. One of the unfortunate results of these was his duel with Armand Carrel, editor of the *National*, in which the latter fell. From this time onward to the revolution of 1848, he was ardently occupied with politics both as a journalist and deputy; and from being a defender of Guizot and moderate liberalism, he became a decided republican.

Girardin was the first to propose Louis Napoleon as a candidate for the presidentship, but only four weeks after the triumph of the latter, he opposed him with the greatest virulence—the reason generally given, being that the president had shown himself unwilling to agree to the political scheme submitted to him by his advocate. Girardin now threw himself into the arms of the socialists. In 1856, he sold his share of the *Presse*, but became editor of it in 1862, eventually abandoning it for the direction of *La Liberté* which he continued till 1870. In 1874 he became editor of the *Journal La France*. Girardin has written a few pieces for the stage. He is very fertile and original in his political ideas, which he has given to the world in a host of brochures.—MADAME DE GIRARDIN, wife of the preceding, whose maiden name was Delphine Gay (born 1804, died 1855), enjoyed during her lifetime a brilliant reputation as a poetess, novelist, and play-writer. Her best known work is her *Lettres Parisiennes*, which appeared in her husband's periodical *La Presse*, under the pseudonym of Vicomte de Launay.

GIRARDIN, JEAN PIERRE LOUIS, b. Paris, 1803; a chemist, professor at Rouen and Clermont. He has paid special attention to the application of chemistry to art, industry, and agriculture, and has published several works on such subjects.

GIRARDIN, SAINT MARC, an eminent French journalist and professor, b. at Paris in 1801. He studied at the collége Napoléon and the collége Henri IV. with brilliant success, and in 1827 obtained a professorship in the collége Louis-le-Grand. During a visit to Germany in 1830, he formed a close intimacy with Gans and Hegel, and on his return to Paris, was appointed to succeed Guizot as professor of history in the faculty of letters, and was named master of requests to the council of state. In 1834, he was called to the chair of poetry at the Sorbonne. About the same time, he was elected a member of the chamber of deputies, and acquired a considerable reputation by his report upon the organization of secondary instruction presented in 1837. In 1844, he was received into the académie. Girardin took no special part in the revolution of 1848. In 1863, he resigned his professorial chair. His influence and popularity as a lecturer, arising from his clearness, good sense, and humor, were very great. He became a member of the national assembly in 1871, and was more than once elected its vice-president, an office which he filled at his death in 1873. Besides his numerous contributions to the *Débats*, which he partly edited from 1827, and to the *Revue des Deux Mondes*, he published several large works, among which are *Notices Politiques et Littéraires sur l'Allemagne* (1834); *Cours de Littérature Dramatique* (1843); and *Tableau de la Littérature au 16th Siècle, suivi d'Etudes sur la Littérature du Moyen Age et de la Renaissance* (1862).

GIRARDON, FRANÇOIS, 1628–1715; a sculptor whose works are typically characteristic of the epoch of Louis XIV. As a boy, he had for master a joiner and woodcarver of his native town, Baudesson by name, under whom he is said to have worked at the chateau of Liébault, where he attracted the notice of the chancellor Séguier. By the chancellor's influence, Girardon was first removed to Paris and placed in the studio of François Anguier, and afterwards sent to Rome. In 1650, he returned to France, and seems at once to have addressed himself with something like ignoble subserviency to the task of conciliating Le Brun, who owed his start in life to the same patron. Girardon is reported to have declared himself incapable of composing a group, whether with truth or from motives of policy it is impossible to say. This much is certain, that

a very large proportion of his work was carried out from designs by Le Brun, and shows the merits and defects of Le Brun's manner—a great command of ceremonial pomp in presenting his subject, coupled with a large treatment of forms which, if it were more expressive, might be imposing. An immense quantity of work at Versailles was intrusted to him, and, in recognition of the successful execution of four figures for the Bains d'Apollon, Le Brun induced the king to present his protegé personally with a purse of 300 louis, as a distinguishing mark of royal favor. In 1650, Girardon was made member of the academy; in 1659, professor; and in 1695, chancellor. Five years before, on the death of Le Brun, he had also been appointed inspector-general of sculpture—a place of power and profit. In 1699, he completed the bronze equestrian statue of Louis XIV., erected by the town of Paris on the Place Louis le Grand. This statue was melted down during the revolution, and is known to us only by a small bronze medal finished by Girardon himself. His "Tomb of Richelieu" (church of the Sorbonne) was saved from destruction by M. Alexandre Lenoir, who received a bayonet-thrust in protecting the head of the cardinal from mutilation. It is a capital example of Girardon's work; but amongst other important specimens yet remaining may also be cited the "Tomb of Louvois" (St. Eutsache), that of Bignon (St. Nicholas du Chardonneret), and decorative sculptures in the Galerie d'Apollon and Chambre du Roi, in the Louvre. Although chiefly occupied at Paris, Girardon never forgot his native Troyes. In the Hotel de Ville is still shown a medallion of Louis XIV., and in the church of St. Remy a bronze crucifix of some importance—both works by his hand. In 1850, M. Corrard de Breban, who has given much time to researches concerning artists native to the town of Troyes, published a *Notice sur la vie et les œuvres de Girardon*. [*Encyc. Brit.*, 9th ed.]

GI'RASOL, a precious stone, exhibiting in strong lights a peculiar and beautiful reflection of bright red or yellow light, which seems to come from the interior of the stone. From this it derives its name (Ital. "sun-turning"). There are different kinds of girasol, variously referred by mineralogists to quartz and opal, species which, however, are very nearly allied. One kind is also known as *fire opal*, which is found only at Zimapan, in Mexico, and in the Faroe islands. The Mexican specimens are of a rich topaz yellow color, and the reflection is very bright. Another kind is the *quartz resinite* of Haüy, so called because of its characteristic resinous fracture. It is found of various colors, sometimes of a fine yellow or emerald green, more generally bluish white. For a specimen of extraordinary brilliancy not an inch and a half in diameter, £1000 has been refused. The ancients held this stone in high estimation. They called it *asteria* (Gr. *aster*, a star). They obtained it both from Caramania and from India. The Caramanian stones were preferred. The brightest are at present brought from Brazil, but fine specimens are also brought from Siberia. Imitation girasols are made of glass, in which a little oxide of tin is mixed.—The name girasol is sometimes given to a kind of sapphire, also called *asteria sapphire*, exhibiting a similar reflection of light, and sometimes to *sunstone*, an avanturine feldspar.

GIRDER, a main beam used to support joisting, walls, arches, etc. Girders may be of wood or iron, and are now very commonly made of cast-iron. They are much used in supporting the upper walls of houses, while the lower part is cut away to allow of rearrangement. Wooden girders are sometimes strengthened with iron trusses, and are then called trussed girders. Sometimes a beam is cut in two, and an iron plate inserted between the pieces, and the whole bolted together. This kind of girder is called a sandwiched beam. Girders are much used in railway works, in which case they are generally of wrought-iron. The Menai and Britannia bridges are simply very large boxed girders. The *lattice* girder is another form in which the sides are made somewhat like wooden lattice-work. See STRENGTH OF MATERIALS.

GIRDLE, a band of leather or other material worn round the waist, either to confine the loose and flowing outer robes so as to allow freedom of movement, or to fasten and support the garments of the wearer. In southern Europe and in all eastern countries the girdle was and still is an important article of dress. Among the Romans it was used to confine the tunica; and so general was the custom that the want of a girdle was regarded as strongly presumptive of idle and dissolute propensities. It also formed a part of the dress of the Greek and Roman soldier; the phrase *cingulum deponere*, to lay aside the girdle, was as equivalent to quitting the service. It was used as now in the east to carry money in; hence *zonam perdere*, to lose one's purse. Girdles and girdle-buckles are not found in early Celtic interments, nor are they frequent in Gallo-Roman graves. But in Frankish and Burgundian graves they are almost constantly present, often ornamented with plaques of bronze or silver, and the clasps and mountings chased or inlaid with various ornamental designs, occasionally including figures of the cross, and rude representations of Scripture subjects. In later times girdles are frequently represented on brasses and monumental effigies from the 12th to the 16th century.. They were either of leather or of woven materials, often of silk and adorned with gold and gems. The mode in which they were worn is shown on the effigies: usually fastened by a buckle in front, the long free end of the girdle was passed up underneath and then down over the cincture, and through the loop thus formed, the ornamented end hung down in front. Among the sumptuary regulations of Edward III., there were prohibitions against wearing girdles of gold and silver unless the wearer

were of knightly rank or worth £200 a year. Similar regulations against extravagance in girdles are occasionally found to the 16th century. The brasses of the 15th c. present many beautiful examples of ladies' girdles, which were often worn like that of the knight with the ornamental end hanging down in front, sometimes with both ends depending from a large clasp or ornamental fastening in the center. Allusions to the girdle are common in the poetry of the 16th and 17th centuries. The purse, the dagger, the rosary, the pen and inkhorn and the bunch of keys, were carried suspended from it, and hence it was an ancient custom for bankrupts or insolvent persons to put off or surrender their girdles in open court. It is recorded that the widow of Philip I., duke of Burgundy, renounced her right of succession by putting off her girdle upon the duke's tomb. The girdle, which was a very important element in the dress of the Levitical priesthood, does not appear as an ecclesiastical vestment in the Christian church until the 8th century. Germanus, who died in 740, mentions the girdle worn by deacons; and Hrabanus Maurus in the succeeding century speaks of the girdle as one of the regular vestments, and refers to its symbolism. Some centuries later the church had to discountenance the extravagance in this article of attire, and splendor in the decoration of girdles was denounced as secular and unbefitting the ecclesiastical character.

GIRDLE OF VENUS (*cestum Veneris*), a very remarkable animal, one of the *acalephæ*, (q.v.), inhabiting the Mediterranean, gelatinous, of a ribbon-like shape, sometimes 5 or 6 ft. in apparent length by about 2 in. in breadth; although considered with reference to the structure of the animal, the apparent length is really its breadth, and the apparent breadth its length. The mouth is situated in the middle of the inferior edge, and the stomach is imbedded in the gelatinous substance. The edges are fringed with cilia, by the movements of which the creature seems to be propelled in the water. It exhibits lovely iridescent colors by day, and brilliant phosphorescence by night. Its substance is so delicate, that a perfect specimen can with difficulty be obtained.

GIR'GEH, a t. of Egypt, is situated on the left bank of the Nile, in lat. 26° 20' n., and long. 31° 58' east. It was here that the discontented Mamelukes rallied against Mohammed Ali. It contains eight handsome mosques, a large bazaar, and a cotton manufactory. The pop. is about 10,000, of whom 800 are Christians, and it has a convent of Catholic missionaries. Girgen is capital of a district with a pop. of 350,000.

GIRGEN'TI. See AGRIGENTUM.

GIRL, in heraldry, is the term used to signify the young of the roe in its second year.

GIR'NAR, a sacred mountain of India of most remarkable aspect, stands in the peninsula of Kattywar, which forms part of the native state of Guzerat, in lat. 21° 30' n., and long. 70° 42' east. Above the mass of luxuriant hills and valleys which surround its base, rises a bare and black rock of granite to the height of about 3,000 ft. above the sea. The summit is broken into various peaks, its northern and southern sides being nearly perpendicular. An immense bowlder, which seems to be poised on one of the scarped pinnacles, is called the Beiru Jhap, or Leap of Death, from its being used by devotees for the purpose of self-destruction.

GIRODET DE ROUSSY, ANNE LOUIS, 1767–1824; better known as Girodet-Trioson. He lost his parents in early youth, and the care of his fortune and education fell to the lot of his guardian, M. Trioson, by whom he was in later life adopted. After some preliminary studies under a painter named Luquin, Girodet entered the school of David, and at the age of twenty-two he successfully competed for the Prix de Rome. At Rome he executed his "Hippocrate refusant les presents d'Artaxerxes," and "Endymion dormant," a work which was hailed with acclamation at the salon of 1792. The peculiarities which mark Girodet's position as the herald of the romantic movement are already evident in his "Endymion." The firm-set forms, the gray, cold color, the hardness of the execution are proper to one trained in the school of David, but these characteristics harmonize ill with the literary, sentimental, and picturesque suggestions which the painter has sought to render. The same incongruity marks Girodet's "Danae," and and his "Quatre Saisons," executed for the king of Spain, and shows itself to a ludicrous extent in his "Fingal," executed for Napoleon I. in 1802. This work unites the defects of the classic and romantic schools, for Girodet's imagination ardently and exclusively pursued the ideas excited by varied reading both of classic and modern literature, and the impressions which he received from the external world afforded him little stimulus or check; he consequently retained the mannerisms of his master's practice, whilst rejecting all restraint on choice of subject. The credit lost by "Fingal" Girodet regained in 1806, when he exhibited "Scène de Deluge," to which (in competition with the Sabines of David) was awarded the decennial prize. This success was followed up in 1808 by the production of the "Reddition de Vienne," and "Atala au Tombeau"—a work which went far to deserve its immense popularity, by a happy choice of subject, and remarkable freedom from the theatricality of Girodet's usual manner, which, however, soon came to the front again in his "Revolte de Caire" (1810). His powers now began to fail, and his habit of working at night and other excesses told upon his constitution; in the salon of 1812, he exhibited only a "Tete de Vierge;" in 1819, "Pyg-

malion et Galatee" showed a still further decline of strength; and in 1824—the year in which he produced his portraits of Cathelineau and Bonchamps—Girodet died.

GIRONDE, a maritime department in the s.w. of France, is formed out of a part of the old province of Guienne, and is bounded on the w. by the bay of Biscay, and on the n. by the department of Charente-Inférieure, on the e. by those of Dordogne and Lot-et-Garonne, and on the s. by that of Landes. It has an area of 3,750 sq.m., and a pop. '76, of 735,242. It is watered mainly by the Garonne and the Dordogne, and by the Gironde, which is formed by the union of these two rivers. The surface of the land is in general flat; but in the e. there are some hills. The climate is temperate, and except in the Landes or sandy tracts, which, however, occupy nearly all the western half of the department, is healthy. In the e. and n.e. the soil is chiefly calcareous. Wine, including the finest clarets, is the great product of the department. The principal growths are those of Lafitte, Latour, Château-Margaux, Haut-brion, Sauterne, Barsac, and the Vins de Grave, and the quantity produced annually averages 50,000,000 gallons. Grain, vegetables, fruit, and hemp are also produced largely. On the w. coast, on the downs or sand-hills, there are extensive plantations of pine, from which turpentine, pitch, and charcoal are obtained. The shepherds of the Landes traverse the sands on high stilts, and travel with them also to markets and fairs. Among the manufactures, salt, calico, muslin, chemical products, pottery, paper, vinegar, and brandy, are the chief. Bordeaux is the capital.

GIRON'DISTS (Fr. *Girondins*), the name given during the French revolution to the moderate republican party. When the legislative assembly met in Oct., 1791, the Gironde department chose for its representatives the advocates Vergniaud, Guadet, Gensonné, Grangeneuve, and a young merchant named Ducos, all of whom soon acquired great influence by their rhetorical talents and political principles, which were derived from a rather hazy notion of Grecian republicanism. They were joined by Brissot's party and the adherents of Roland, as well as by several leaders of the center, such as Condorcet, Fauchet, Lasource, Isnard, and Henri La Rivière, and for some time had a parliamentary majority. They first directed their efforts against the reactionary policy of the court, and the king saw himself compelled to select the more moderate of the party, Roland, Dumouriez, Clavière, and Servan, to be ministers. Ultimately, however, he dismissed them, a measure which led to the insurrection of June 20, 1792. The encroachments of the populace, and the rise of the Jacobin leaders, compelled the Girondists to assume a conservative attitude; but though their eloquence still prevailed in the assembly, their popularity and power out-of-doors were wholly gone, and they were quite unable to prevent such hideous crimes as the September massacres The principal things which they *attempted* to do after this—for they never succeeded in accomplishing anything—were to procure the arrestment of the leaders of the September massacres, Danton, etc.; to overawe the mob of Paris by a guard selected from all the departments of France; to save the king's life by the absurdest of all possible means, viz., by first voting his death, and then by intending to appeal to the nation; and, finally, to impeach Marat, who, in turn, induced the various sections of Paris to demand their expulsion from the assembly and their arrestment. This demand, backed up as it was by 170 pieces of artillery under the disposal of Henriot (q.v.), leader of the sans-culottes, could not be resisted; thirty of the Girondists were arrested on a motion of Couthon, but the majority had escaped to the provinces. In the departments of Eure, Calvados, and all through Brittany, the people rose in their defense, and under the command of gen. Wimpfen, formed the so-called "federalist" army, which was to rescue the republic from the hands of the Parisian populace. Movements for the cause of the Girondists took place likewise at Lyons, Marseilles, and Bordeaux. The progress of the insurrection was, however, stopped by the activity of the convention. On July 20, the revolutionary army took possession of Caen, the chief station of the insurgents, whereupon the deputies of the convention, at the head of the sans-culottes, forced their way into the other towns, and commenced a fearful retribution.

On Oct. 1, 1793, the prisoners were accused before the convention by Amar, as the mouthpiece of the committee of public safety, of conspiring against the republic with Louis XVI., the royalists, the duke of Orleans, Lafayette, and Pitt, and it was decreed that they should be brought before the revolutionary tribunal. On the 24th, their trial commenced. The accusers were such men as Chabot, Hébert, and Fabre d'Eglantine. The Girondists, however, defended themselves so effectually, that the convention on the 30th was obliged to come forward and decree the closing of the investigation. That very night, Brissot, Vergniaud, Gensonné, Ducos, Fonfrède, Lacaze, Lasource, Valazé, Sillery, Fauchet, Duperret, Carra, Lehardy, Duchâtel, Gardien, Boileau, Beauvais, Vigée, Duprat, Mainvielle, and Antiboul, were sentenced to death, and, with the exception of Valazé, who stabbed himself on hearing his sentence pronounced, all perished by the guillotine. On their way to the place de Grève, in the true spirit of French republicanism, they sang the *Marseillaise*. Coustard, Manuel, Cussy, Noel, Kersaint, Rabaut St. Etienne, Bernard, and Mazuyer, were likewise afterwards guillotined. Biroteau, Grangeneuve, Guadet, Salles, and Barbaroux ascended the scaffold at Bordeaux. Lidon and Chambon, at Brives; Valady, at Périgueux; Dechézeau, at Rochelle. Rebecqui drowned himself at Marseilles, Pétion and Buzot stabbed themselves, and Con-

dorcet poisoned himself. Sixteen months later, after the fall of the terrorists, the outlawed members, including the Girondists Lanjuinais, Defermon, Pontécoulant, Louvet, Isnard, and La Rivière, again appeared in the convention. A rather flattering picture of the party has been drawn by Lamartine, in his *Histoire des Girondins* (8 vols., Paris, 1847).

GIRONNÉ, GYRONNÉ, GYRONNY (Lat. *gyrus*, a circle), terms used in heraldry to indicate that the field (q.v.) is divided into six, eight, or more triangular portions, of different tinctures, the points of the triangles all meeting in the center of the shield. Nisbet (i. 28) objects to this as a vulgar mode of blazoning, and, in speaking of the "paternal ensign of the ancient surname of Campbell," he says (p. 81) that it is "composed of the four principal partition lines, parti, coupé, traunché, taillé, which divide the field into eight gironal segments, ordinarily blazoned with us, girony of eight, or, and sable." The triangle in dexter-chief has been called a giron or gyron.

GIR'VAN, a seaport t. and burgh of barony, on the w. coast of Scotland, is beautifully situated at the mouth of the river Girvan, in the county of Ayr, and about 21 m. s.w. of the town of that name. It is connected with Glasgow by the Glasgow and South-western railway, and with Stranraer by the Girvan and Portpatrick Junction railway. The harbor has been much improved of late, and a considerable trade, especially in the shipment of coal, is carried on betwixt Girvan and Belfast, from which it is distant about 65 miles. The valley of the Girvan is one of the most beautiful and best cultivated districts in the s.w. of Ayrshire, and abounds with coal and with limestone. The land is of the richest description. The town is situated opposite the celebrated "Ailsa Craig," and has been much frequented of late in the summer season by parties in quest of sea-bathing, for which the coast is admirably adapted. Pop. '71, 4,776.

GISORS, a t. of France, in the department of Eure, situated on the river Epte, 33 m. n.e. of Evreaux, and on the high-road from Paris to Rouen. Pop. '76, 3,590. Here a battle took place, Oct. 10, 1198, between the French and English, in which the former were completely defeated. Richard I., who commanded the English, gave, as the "parole," or watchword, *Dieu et mon Droit* (God and my right), which ever since has been the motto of the royal arms of England.

GIT'SCHIN, or GICZIN, a t. of Bohemia, the capital of a district or circle, stands on the Cydlina, 48 m. n.e. of Prague. It consists of the town proper and four suburbs, and has a population of about 6,000. There are important corn-markets. The former Jesuits' college is now used as barracks; but there are a gymnasium and other schools. Gitschin was once the capital of the duchy of Friedland. When Wallenstein chose it in 1627 for his residence, it was merely a collection of some 200 miserable hovels; his activity and munificence soon converted it into an elegant and prosperous city, in which he built (1630) a splendid palace. His body, in 1639, was laid in the neighboring Carthusian monastery of Walditz; three years after the Swedish gen. Baner sent the head and right hand to Sweden; the remains lay neglected for a century, until they were removed by Count von Waldstein to Münchengrätz.

GIUDICI, PAOLO EMILIANI, b. 1812; an Italian author, professor in the Pisa university, and in the royal academy of fine arts in Florence. In 1867, he was a member from Sicily in the Italian parliament. He has published *Storia dei Comuni; Storia del teatro Italiano*, and a translation of Macaulay's *History of England*.

GIUGLIA'NO, a market t. of s. Italy, 8 m. n.w. of Naples. It contains four churches, a castle, and a hospital. Pop. '71, 11,772.

GIULI'NI, GIORGIO, a learned historian and antiquary, was b. at Milan in 1714. He studied law at the university of Padua, and received the degree of doctor at an early age. Giulini devoted his decided antiquarian genius to researches into the monuments and remains of his native land; and after twenty years of patient labor, he published a valuable historical work, entitled *Memoirs concerning the Government of Milan, with Description of the City and Milanese Territory from the Early Ages.* These memoirs, in 4 vols., embrace the period from the destruction of the Lombard domination, or establishment of the Franks in Italy, down to the opening of the 14th century. In three subsequent books he descends to 1447, when the house of Visconti was elevated to sovereign rule in Milan. The work is considered by Giulini's countrymen a masterpiece of learning, impartiality, and judgment. Much of the history is based upon the evidence of coins, seals, documents, and monuments of the various ages. Milan proudly recognized Giulini's patriotic labor by appointing him state historian, and, at the request of the empress Maria-Theresa, he collected materials for four additional books, with the view of bringing the work down to the 16th century. Before achieving this design, he died of apoplexy on Christmas Eve, in 1780. Giulini was distinguished for active benevolence as well as learning. He likewise cultivated with enthusiasm both poetry and music.

GIULIO PIPPI, surnamed "ROMANO" from the place of his birth, was b. at Rome in 1492, and became one of Raphael's most distinguished and beloved pupils. His excellence as an architect and engineer almost equaled his genius as a painter. Giulio Pippi assisted Raphael in the execution of several of his finest works, and by special desire of the great master he was intrusted with the completion of all his unfinished designs

after his death. He likewise inherited a great portion of Raphael's wealth. The works executed by Giulio Pippi, in imitation of Raphael, reflect so wonderfully, not alone the style and character, but the sentiment and spirit of the original, that in many instances uncertainty has arisen as to the hand from which they emanated; while, on the contrary, the more original creations of Giulio Pippi are deficient in the ideal grace of his master, and display rather breadth, and power of treatment, and boldness of imagination, than poetical refinement or elevation. Unlike Raphael, the chief excellence of Giulio Pippi does not lie in his conception of the *divine* or Christian, but rather of the *classical* ideal. Giulio Pippi died in 1546.

The principal architectural works designed by Giulio Pippi were executed at Mantua, during his lengthened residence at the court of duke Frederick Gonzaga. The drainage of the marshes surrounding Mantua, and the securing the city from the frequent inundations of the rivers Po and Mincio, attest his skill as an engineer; while his genius as an architect found free scope in the restoration and adornment of many of the chief public edifices of Mantua, and especially in the erection of the splendid palace known as Il Palazzo del Te, which he also embellished with mythological frescos, and a profusion of exquisite decorations. Many of Giulio Pippi's finest pictures passed into the possession of Charles I. of England, who purchased, in 1629, the celebrated collection of the dukes of Mantua. Several of them are now contained in the Hampton court gallery; but the finest of all, a "Nativity," was sold to France, and now adorns the Louvre. The Naples gallery of Capi d'Opera, possesses a Holy Family by Giulio Pippi, called the "Madonna della Gatta," and considered the greatest of his pictures; it is strongly imbued with the spirit and influence of Raphael. The Loggia of Raphael, in the Vatican, also contains some fine frescos executed by Giulio Pippi; and in the Palazzo Farnese there is a grand frieze attributed to him.

GIUNTA PISANO, the earliest Italian painter whose name is found inscribed on an extant work, exercised his art from 1202 to 1236; he may perhaps have been born towards 1180, in Pisa, and died in, or soon after, 1236. There is some ground for thinking that this family name was Capiteno. In recent times some efforts have been made to uphold his deservings as an artist, thereby detracting so far from the credit due to the initiative of Cimabue; but it cannot be said that these efforts rest on a very solid basis. To most eyes the performances of Giunta merely represent a continuous stage of the long period of pictorial inaptitude. The inscribed work above referred to, one of his earliest, is a crucifix, now or lately in the kitchen of the convent of St. Anne, in Pisa. Other Pisan works of like date are very barbarous, and some of them may also be from the hand of Giunta. It is said that he painted in the upper church of Assisi,—in especial, a crucifixion dated 1236, with a figure of father Elias, the general of the Franciscans, embracing the foot of the cross. In the sacristy is a portrait of St. Francis, also ascribed to Giunta; but it more probably belongs to the close of the 13th century. This artist was in the practice of painting on cloth stretched on wood, and prepared with plaster.

GIURGE'VO, an important trading t. of Roumania, is situated on the left bank of the Danube, directly opposite Rustchuk, and 40 m. s.s.w. from Bucharest, of which town it is the port. It was originally the Genoese settlement of St. George. It is the great landing-place for steamers in Wallachia. A bridge across a narrow channel connects Giurgevo with Slobodse, an island in the Danube, on which stands a fortified castle. Here the Turks defeated the Russians, July 7, 1854. Pop. 15,000.

GIUS'TI, GIUSEPPE, the most celebrated and popular of the modern poets and satirists of Italy, was b. in 1809, at Pescia, in the vicinity of Florence. Sprung from an influential Tuscan family, Giusti was early destined to the bar, and at Pistoja and Lucca commenced the preliminary studies, which were completed at the university of Pisa, where he obtained his degree of doctor of laws. Sustained earnestness of study seems to have formed no feature in Guisti's collegiate course, whose natural bent rather inclined him to a genial participation in the freaks and social pleasures of his companions than to the erudite investigation of the Pandects. On quitting Pisa, Giusti was domiciled at Florence with the eminent advocate Capoquadri, who subsequently became minister of justice, and here he first attempted poetry. Lyrical compositions of the romantic school, evincing both elevated and nervous thought, were his earliest efforts; but he speedily comprehended that satire, not idealism, was his true forte. In a pre-eminent degree, Giusti possesses the requirements of a great lyrical satirist—terse, clear, and brilliant, he depicts, alternately with the poignant regret of the humanitarian and the mocking laugh of the ironist, the decorous shams and conventional vices of his age. His impartiality only lends a keener sting to his denunciation. The stern flagellator of tyrants, he is no less merciless in stigmatizing those whose pliant servility helps to perpetuate the abasement of their country. Nor does he adulate the people, whose champion he avowedly is, and whose follies and inconsistencies he indicates with the faithfulness of a watchful friend. The writings of Giusti exercised a positive political influence. When the functions of the press were ignored, and freedom of thought was treason, his flaming verses in manuscript were throughout all Italy in general circulation, fanning the hatred of foreign despots, and powerfully assisted in preparing the revolutionary insurrection of 1848. Then for the first time, did Giusti discard the

pseudonym of "The Anonymous Tuscan," and append his name to a volume of verses bearing on the events and aims of the times. All his compositions are short pieces, rarely blemished with personalities, and written in the purest form of the popular Tuscan dialect. The elegant familiarity of idiom which constitutes one of their chief and original beauties in the eyes of their native readers, presents great difficulties to foreigners, and still greater to the translator. Giusti's writings are not only Italian in spirit and wit, but essentially Tuscan. A reverent student of Dante, Giusti himself often reaches an almost Dantesque sublimity in the higher outbursts of his scornful wrath, while he stands alone in the lighter play of ironical wit. In politics, an enlightened and moderate liberal, averse alike to bureaucracy and mobocracy, Giusti was also beloved in private life for his social qualities, and his loving and gentle spirit. He died in 1850, aged 41, in the dwelling of his attached friend, the marquis Gino Capponi, at Florence; and the throng of citizens who followed him to the grave, in the teeth of Austrian prohibition, attested eloquently the repute he enjoyed in life. His most celebrated pieces are entitled *Stivale*, or the History of a boot (Italy), a humorous narration of all the misfits, ill-usage, and patching allotted to this unfortunate down-trodden symbol of his country; *Gingillino*, a master-piece of sarcasm, portraying the ignoble career of the sycophant, whose supple back and petty diplomacy finally secure for him the highest distinctions; *Il Re Travicello*, or King Log, the subject of which is indicated by the title; *Il Brindisi di Girella*, or the Weathercock's Toast, one of his best pieces, dedicated to the suggestive name of Talleyrand: and the *Dies Iræ*, or funeral oration of the emperor Francis I. The only authorized and correct edition of his works is that published at Florence in 1852 by Le Monnier.

GIUSTINIA'NI, an illustrious Italian race, to which the republics of Venice and Genoa owed more than one doge. One of the palatial residences of Rome was erected towards the end of the 16th c. by a descendant of the family, the marquis Giustiniani. The site he selected for the palace was a portion of the ruins of Nero's baths, and on its completion he enriched it with a magnificent private gallery of paintings, and a fine collection of sculptures. He also formed a museum of antiquities, the treasures of which were discovered on the spot. In 1807, the Giustiniani family conveyed the collection of paintings to Paris, where they disposed of the greater part by auction, and privately sold the remainder, consisting of 170 fine paintings, to the artist Bonnechose, who, in his turn, resold them to the king of Prussia. This fragment of the famous Giustiniani gallery now enriches the Berlin museum, and a very few of its former treasures are still to be found in the Giustiniani palace at Rome.

GIVET, a t. of France, and a fortress of the first rank, is situated in the department of Ardennes, on both banks of the Meuse, close to the border of Belgium, and 145 m. n.e. of Paris. The town consists of three districts—Charlemont, Givet St. Hilaire, and and Givet Notre Dame, all lying within the line of the fortifications. It is well situated in a commercial point of view, is regularly built, has handsome squares, a good port, barracks, a military hospital, and manufactures of leather, for which Givet is famous, of white-lead, clay-pipes, sealing-wax, and nails; breweries, marble-works, and a zinc and copper foundry are also carried on. Pop. '76, 5,275.

GIVORS, a t. of France, in the department of Rhone, is situated on the right bank of the river of that name, 14 m. s. of Lyons. Bottles and window glass are here extensively manufactured, and a trade in ironstone and coal is carried on. Pop. '76, 10,856.

GIZZARD, a strong and muscular portion of the alimentary canal, in birds especially, for grinding the coarse food upon which they subsist. Some of the Bryozoa have such a gizzard between the oesophagus and true stomach. Many gasteropods have gizzards armed with teeth or calcareous plates, and some cephalopods have both powerful jaws and strong gizzards between the crop and the first stomach. Many insects and crustaceans have gizzards, in some cases armed with strong teeth. Most birds have a true gizzard, excepting only those whose food is soft and succulent. The food is acted upon by gastric juice before it is ground up in the gizzard. This organ is the homologue of the pyloric portion of the stomach of most of the vertebrates. It is lined by a horny epithelium, the "gizzard skin," and most birds swallow pieces of gravel to assist the gizzard in grinding the food.

GLA'CIER is a name given to immense masses of ice, which are formed above the snow-line, on lofty mountains, and descend into the valleys to a greater or less distance, often encroaching on the cultivated regions. The materials of the glaciers are derived from the snow which falls during summer as well as winter on the summits of high mountains. Every fresh fall of snow adds a little to the height of the mountain, and, were there no agents at work to get rid of it, the mountains would be gradually rising to an indefinite elevation. Avalanches and glaciers, however, carry the snow into warmer regions, where it is reduced to water; in the one, the snow slips from the steep mountain slopes, and rushes rapidly down; in the other, it gradually descends, and is converted into ice in its progress. The snow which forms the glacier at its origin has a very different appearance and consistence from the ice of which it consists at its lower termination. The minute state of division of the ice, in its snow condition, and the quantity of air interspersed through it, gives it its characteristic white color. Two

causes operate in causing this change into ice; first, pressure expels the air, by bringing the particles of the lower layers of snow more closely together; and second, the summer's heat, melting the surface, the water thus obtained percolates through the mass beneath, and as it passes amongst the particles whose temperature is below 32° F., it increases their size by external additions till the particles meet, and the whole becomes a solid mass. The snowy region of the glacier is called by the French name *névé*. In large glaciers, the névé is of great extent, a large quantity of material being required to make up the waste. The névé is, however, often confined to narrow valleys, and, as a consequence, produces glaciers which soon perish. The increase of a glacier by snow falling on its surface takes place only above the snow-line—below that line, all the accumulated winter's snows are speedily melted by the summer heat. The ice of the glacier seldom exhibits any traces of the horizontal stratification which is found in the névé, but is generally intersected with vertical veins of clear blue ice.

The most remarkable feature of glaciers is their motion. It has been long known to the natives of the Alps that they move, but it is only within the last few years that it has received due attention from scientific men; the account of their observations, and the theories based upon them, form one of the most interesting chapters in the history of glaciers. See the writings of Agassiz, Forbes, and Tyndall. The continual waste of glaciers below the snow-line, both along its surface and at its extremity, is ever being repaired, so that the glacier does not recede from the valley, nor decrease in depth. That the materials of the reparation are not derived from the fall of the winter's snow and the influence of the winter's frost, is evident, inasmuch as these additions speedily disappear with the return of the summer's heat, and in the end form but a small proportion of the year's total loss. The true repairing agent is the motion of the glacier, which brings down the glacified snow from the upper regions to be melted below. To account for this motion, Charpantier supposed the water which saturated the glacier in all its parts, and filled the innumerable capillary fissures, was, during night and during the winter, frozen, and that the well known and almost irresistible expansion which would take place in the conversion of the water into ice, furnished the force necessary to move the glacier forwards. This theory, known as the *dilatation theory*, was for some time adopted by Agassiz, but ultimately abandoned. Agassiz showed that the interior of the glacier had a temperature of 32° F., and subsequent observations have shown that the glacier moves more rapidly in summer than in winter. In 1799, De Saussure published a second theory, known as the *gravitation* or *sliding theory*, in which he supposed that the glacier moved by sliding down the inclined plane on which it rested, and that it was kept from adhering to its bed, and sometimes even elevated by the water melted in the contact of the glacier with the naturally warmer earth. While correctly attributing the motion to gravity, De Saussure erred in considering glaciers as continuous and more or less rigid solids—indeed, the motion he attributes to them would, if commenced, be accelerated by gravity, and dash the glacier from its bed as an avalanche. Principal Forbes was the author of the next important theory. Considerable attention had in the meantime been paid to the subject by Rendu, Agassiz, and others. Rendu had shown that the glacier possessed a semi-fluid or river-like motion, in explaining the difference between observations made by him at the center, which "moves more rapidly," and others made at the sides, "where the ice is retained by the friction against its rocky walls." The results based on Rendu's observations were established by the repeated and exact measurements of Forbes, who, in the progress of his examinations, made the further discoveries, that the surface moves more rapidly than the ice near the bottom, and the middle than the sides; that the rate of motion is greater where the glacier-bed has the greatest inclination; and that the motion is continued in winter, while it is accelerated in summer by the increase of the temperature of the air. The only theory which, as it appeared to Forbes, could account for these phenomena is thus expressed by him: "A glacier is an imperfect fluid or a viscous body, which is urged down slopes of a certain inclination by the mutual pressure of its parts." This is known as the *viscous theory*. He considered a glacier as not a crystalline solid, like ice tranquilly frozen in a mold, but that it possessed a peculiar fissured and laminated structure, through which water entered into its intrinsic composition, giving it a viscid consistence, similar to that possessed by treacle, honey, or tar, but differing in degree. Prof. Tyndall has published another theory, which he designates the *pressure theory*. This differs little from that of Forbes, except that it denies that glacier ice is in the least viscid. By a number of independent observations, he established the facts first noticed by Rendu and Forbes, and added the important one, that the place of greatest motion is not in the center of the glacier, but in a curve more deeply sinuous than the valley itself, crossing the axis of the glacier at each point of contrary flexure—in fact that its motion is similar to that of a river whose point of maximum motion is not central, but deviates towards that side of the valley towards which the river turns its convex boundary. This seems a further corroboration of the viscous theory, but Tyndall explained it and the other facts by a theory which, while maintaining the *quasi*-fluid motion of the glacier, denied that this motion was owing to its being in a viscous condition. The germ of his theory, as he tells us, was derived from some observations and experiments of Faraday's in 1850, who showed "that when two pieces of ice, with moistened surfaces, were placed in contact, they

became cemented together by the freezing of the film of water between them, while, when the ice was below 32° F., and therefore *dry*, no effect of this kind could be produced. The freezing was also found to take place under water." By a further series of experiments, Tyndall found that ice at 32° F. could be compressed into any form, and that no matter how great the bruising of its particles and the change of its shape, it would, from this property of regelation, re-establish its continuous solid condition, if the particles of ice operated on were kept in close contact. These facts he applied to the motion of glaciers, asserting that the pressure of the parts of a glacier on each other, in a downward direction, produced by gravitation, was more powerful than the attraction which held the particles of the ice together—that, consequently, the ice was ruptured, to permit the motion of the glacier, the particles being, however, speedily reunited by regelation. The supposed viscous condition of ice he believed to be refuted by the fact that, whenever the glacier is subjected to tension, as in passing over a cascade, it does not yield by stretching, but always by breaking, so as to form crevasses. This theory, equally with that of Forbes, explains the known phenomena of glaciers, while the advantage is claimed for it of not drawing upon our imagination as to a required condition of the ice, but, by experiment, exhibiting ice from known causes producing effects on the small scale similar to those produced in nature on the large. Forbes, however, maintained (*Occasional Papers*, etc., 1859) that all that is peculiar to Tyndall's theory was included in his own: and that the facts discovered and expounded by Faraday in 1850 had already been used by him as part of his theory in 1846. He said that his viscous theory included the notion "of an infinity of minute rents; that it also embraces the substitution of the finite sliding of the internally bruised surfaces over one another;" and that it includes the "reconsolidation of the bruised glacial substance into a coherent whole by pressure acting upon ice, softened by imminent thaw."

Prof. Tyndall re-introduces and re-asserts the gravitation theory of De Saussure as in part the cause of the glacier's motion; but the phenomena which he considers produced by a sliding motion of the whole mass over its bed—viz., the polishing and grooving of the rock below—can be produced by a substance whose motion is the result of a yielding of its parts, if that substance has sufficient consistence to retain firmly imbedded in its lower surface portions of rock to act as polishers, and it cannot be doubted that the ice of glaciers has such a consistency.

Some of the more remarkable phenomena of glaciers remain to be noticed. The surface of the glacier does not long retain the purity of the snow from which it is derived, but is speedily loaded with long ridges of débris called *moraines*. The mountains which rise on either side of the valley occupied by the glacier are continually suffering loss from the action of the rain, disruption by frost, and the impulse of avalanches. The materials thus liberated find their way to the glacier, and form a line of rock and rubbish on its two borders, of greater or less size, dependent on the friability or compactness of the adjacent mountains. The *lateral moraines* often reach to a great height, as much as 40 or 50 ft. above the level of the glacier. The whole ridge appears to consist of débris, but it is really a ridge of ice with a covering of foreign materials, which, by protecting the underlying ice from the heat which they radiate and only partially transmit, leave the moraine as a more and more elevated ridge, while the surface of the glacier is speedily melting. *Glacier tables* have a similar origin. A large and isolated mass of rock, resting on the glacier, protects the ice below; and as the glacier melts, it leaves the rock poised on the summit of an icy column. As the rays of the sun play on the table all day obliquely, the column is gradually melted from under the rock, until it slips off, and begins to form another table; while the unprotected column speedily melts and disappears. Where two glaciers unite, the trails of rock on the inner margins unite also and form a single ridge, which runs along the middle of the large trunk glacier, and is called a *medial moraine*. It is evident that the number of the medial moraines must thus depend upon the number of the branch glaciers, and must indeed be invariably one less. The glacier terminates amidst a mass of stones and débris, which having been carried down on its surface, are finally deposited by its melting at its extremity, forming there a *terminal moraine*, Sometimes a glacier decreases in size, either withdrawing from the valley, and leaving the terminal moraine as a barren waste of rocks, or melting on its superfices throughout its length, and depositing its lateral moraines as a ridge of débris on either side at some height above it on the mountain. The existence of such collections of rocks is plain evidence of the former position and altitude of glaciers, and even of their former occurrence in countries where they are now unknown.

It has been stated, that when the glacier is subjected to tension, the continuity of its parts is destroyed, and fissures called *crevasses*, are formed. In passing over a brow on the channel, the ice invariably yields; at first, a deep crack is formed, which gradually widens until a fissure or chasm is produced across the glacier. Tranverse crevasses disappear when the glacier reaches a level portion of its bed; the pressure bringing the walls again together, the chasm is closed up. Longitudinal crevasses are produced when the glacier escapes from a confined channel, and spreads itself over a wider area. The spreading of the margins causes a tension in the body of the glacier, which yields, and longitudinal fissures are formed. These occasionally rend the terminal front of a glacier. The smaller marginal crevasses are formed from the tension of the ice, pro-

duced by the normal motion of the glacier being retarded by the friction against the sides of its channel. The motion of the glacier is gradually accelerated from the margin inwards, consequently the lines of greatest tension are inclined downwards and towards the center, more or less, in proportion to the rapidity of the motion. The crevasses formed by the yielding of the ice are at right angles to the lines of tension, and consequently point up the glacier.

The *veined structure* is apparently the result of pressure. The veins consist of blue ice penetrating the white mass of the glacier, and occur either in irregular directions, or producing a regularly laminated structure. The blue veins are portions of ice from which the air-bubbles have been expelled, and which are consequently more compact than the general substance of the glacier. The pressure is exerted in three directions, producing veins which are complementary to the three kinds of crevasses which have just been noticed. When the glacier passes over a level, or perhaps a gently rising channel, transverse veins are formed; when it is pressed through a narrower channel, longitudinal veins are produced; and the pressure at the margins produced by the retardation of the flow by friction causes the formation of marginal veins in the lines of greatest pressure, that is, at right angles to the marginal crevasses.

The melting of the ice on the surface of the glacier produces streams, whose course is often broken by crevasses, down which the water descends, finding egress at last through the cavernous mouth at the termination of the glacier, where it issues after being increased by other streams, which have by similar channels reached the bottom, as well as by the melting of the ice from the contact of the earth. The rushing water wears a shaft of greater diameter than the crevasse, and this shaft often remains after the margins of the crevasse have been reunited. In the progress of the glacier, another crevasse intersects the bed of the stream, and down this the water is diverted, leaving the formed shaft or *moulin*, as it is called. The forsaken moulin has at its base a quantity of earth and stones collected by the stream from the surface of the glacier, these are gradually raised to the surface by the melting of the glacier, and eventually appear as cones of débris, sometimes rising high on columns of ice under the same influences as the glacier tables.

Glaciers are not necessarily peculiar to any country or zone, but wherever there are mountains of sufficient height, it may be expected that they may exist. In Europe, they are chiefly confined to the Alps and Norway. Having their origin in the region of perpetual snow, they reach far down into the valleys, the largest pushing themselves furthest down. That of Bossous at Chamouni, which comes from the highest part of Mont Blanc, reaches a point 5,500 ft. below the snow-line, where it is embosomed amongst luxuriant wood, and is almost in contact with cornfields. Hooker and others have described the glaciers of the Himalaya. Iceland and Spitzbergen also abound in glaciers. It is in such northern localities that the ends of the glaciers, resting on the waters of the ocean, get broken off by transverse crevasses, and float away as icebergs.

It has already been noticed that the former existence of glaciers is indicated by the occurrence of moraines. These have been noticed in various localities in Wales, England, and Scotland. They are referred to the period when the bowlder-clay (q.v.) was deposited; and this, with the sands und gravels which are associated with it, are sometimes included under the title glacial deposits.

GLA'CIS (allied to glade in the sense of a lawn), in fortification (q.v.), the slope of earth, usually turfed, which inclines from the covered-way towards the country. Its object is to bring assailants, as they approach, into a conspicuous line of fire from the parapet of the fortress, and also to mask the general works of the place.

GLADBACH, or BERGISCH-GLADBACH, a t. of Rhenish Prussia, in the former duchy of Berg, and in the government of Cologne, 8 m. n.e. from Cologne. It is a place of considerable industrial activity, and has manufactures of nets, paper, and percussion caps. Pop. '75, 7,030.

GLADBACH, or MÖNCHEN-GLADBACH, a t. of Rhenish Prussia, in the government of Düsseldorf, 14 m. w. from Düsseldorf, pleasantly situated on a rising ground near the left bank of the Niers. It is a principal seat of the manufacturing industry of Rhenish Prussia, and has increased very rapidly within the last 25 years. Besides being a station on the railway between Aix-la-Chapelle and Westphalia, it is connected by another line with Düsseldorf. Among the branches of manufacture carried on, are the weaving of linen and cotton, druggets, and velvets. There are also extensive dye-works and bleach-fields. Much flax is grown in the neighborhood. Gladbach is a very ancient town, having existed at least as early as the days of Charlemagne. It formerly contained a famous Benedictine abbey, founded by archbishop Gers of Cologne, in 972. Pop. '75, 31,962.

GLADDEN, WASHINGTON, b. Penn., 1836; graduated at Williams college in 1859. He has been pastor of Congregational churches in Brooklyn and Morrisania, N. Y., and North Adams, Mass.; and was an editor of the *Independent*, in New York, and the *Sunday Afternoon*, afterwards named *Good Company*, in Springfield, Mass. He is now pastor of the North Congregational church in Springfield. He has been also a popular and successful lecturer, and a frequent contributor to periodicals. He has published

From the Hub to the Hudson, Plain Talks on the Art of Living, and *Workingmen and their Employers.*

GLADE-NET, a kind of net used for the capture of birds in the glades of forests. It is much used both in England and in some parts of the continent of Europe for the capture of woodcocks. It is made of a breadth suitable to the glade in which it is to be suspended, through which the birds are known to be accustomed to pass; and is made of fine thread-netting, edged with cords, having weights attached to it below, so that when the rope by which it is held up is let go, it falls at once to the ground; a rope from the upper part of it passing over a pulley in a tree, and being held by the hand of the fowler. When the net is ready, the neighboring parts of the wood are beaten, to disturb the woodcocks; and when they approach it, it is let down, or drawn up, as may be necessary. In England, the use of the glade-net is common chiefly among poachers and gamekeepers, who, without the knowledge of their employers, but tempted by the high price of woodcocks, resort to this method of obtaining money. Other birds, and sometimes hares, are also caught in the glade-net. In Siberia, the glade-net is employed for the capture of wi'd-fowl, and glades are opened, in order to its use, between one lake and another, or between a lake and a river near together.

GLADHEIM, in Norse mythology, the dwelling-place of Odin, the largest and noblest of edifices. In this home is Valhalla (the hall of heroes), radiant with gold, to which are conducted all who fall in battle. The ceiling is formed of spears; the roof of shields, and the benches are strewn with coats of mail. It has 540 gates, through each of which 800 men can go abreast.

GLADIATOR, in antiquity, from *gladius*, a sword, was one who fought in the arena, at the amphitheater at Rome, and in other cities, for the amusement of the public. The gladiators were generally slaves, bought and trained for the purpose, by masters who made this their business. The custom is supposed to have been borrowed from the east, and to have had its origin in the practice of human sacrifices, or that of taking the lives of captives or prisoners of war, in honor of heroes who had died in battle. Thus, in the *Iliad*, we read that Achilles sacrificed twelve Trojan prisoners to the manes of his friend Patroclus, and Virgil speaks of captives sent to Evander, to be sacrificed at the funeral of his son Pallas. The "great custom" of the king of Dahomey thus finds warrant in classic antiquity; and the North American Indians, in putting their prisoners to death with tortures, have only refined upon an ancient barbarism.

After a time, all considerable funerals were solemnized by human sacrifices, which took the form of combats, in which, to increase the interest of the spectators, the prisoners were required to sacrifice each other; and as prisoners, and afterwards other slaves, were kept for this purpose, they were trained to fight with skill and courage, to make the spectacle more impressive. These contests first took place at funerals, but afterwards in the amphitheater; and in process of time, instead of a funeral rite, became a common amusement. The first we read of in Roman history was the show of a contest of three pairs of gladiators, given by Marcus and Decius Brutus, on the death of their father, in the year of Rome 490. In the year 537, a show of 22 pairs was given in the Forum. In 547, the first Africanus diverted his army at New Carthage with a gladiatorial exhibition. The fashion now rapidly increased. Magistrates, public officers, candidates for the popular suffrages, gave shows to the people, which consisted chiefly of these bloody and generally mortal encounters. The emperors exceeded all others in the extent and magnificence of these cruel spectacles. Julius Cæsar gave a show of 320 couples; Titus gave a show of gladiators, wild-beasts, and sea-fights for 100 days; Trajan gave a show of 123 days, in which 2,000 men fought with and killed each other, or fought with wild-beasts for the amusement of the 70,000 Romans, patricians, and plebeians, the highest ladies and the lowest rabble, assembled in the Colosseum. A vast number of slaves from all parts of the world were kept in Rome, and trained for these exhibitions. There were so many at the time of Cataline's conspiracy, that they were thought dangerous to the public safety, and it was proposed to distribute them among the distant garrisons.

Efforts were made to limit the number of gladiators, and diminish the frequency of these shows. Cicero proposed a law, that no man should give one for two years before becoming a candidate for office. The emperor Augustus forbade more than two shows in a year, or that one should be given by a man worth less than half a million sesterces; but it was difficult to restrain what had become a passion, and men even had such contests for the amusement of their guests at ordinary feasts.

These shows were announced by show-bills and pictures, like the plays of our theaters. The gladiators were trained and sworn to fight to the death. If they showed cowardice, they were killed with tortures. They fought at first with wooden swords, and then with steel. When one of the combatants was disarmed, or upon the ground, the victor looked to the emperor, if present, or to the people, for the signal of death; if they raised their thumbs, his life was spared; if they turned them down, he executed the fatal mandate. A gladiator who had conquered was rewarded with a branch of palm, and sometimes with his freedom. Though the gladiators at first were slaves, freemen afterwards entered the profession, and even knights. Senators and knights fought in the shows of Nero, and women in those of Domitian. The emperor Constan-

tine prohibited the contests of gladiators, 325 A.D.: but they could not at once be abolished. In the reign of Honorius, Telemachus went into the arena to stop the fight, when the people stoned him. They were finally abolished by Theodoric, 500 A.D.

GLADI'OLUS, a genus of plants of the natuarl order *irideæ*, with a tubular perianth the limb of which is divided into six unequal segments, thread-like, undivided stigmas, and winged seeds. The roots are bulbous; the leaves linear or sword-shaped, whence the name (Lat. a little sword). The cape of Good Hope produces a greater number of the known species, as well as of several allied genera once included in this. A few, however, are natives of other countries, and two or three are found in Europe. None are British. Most of the species have flowers of great beauty; and some of them are among the finest ornaments of our flower-borders and green-houses. They are propagated either by seed or by offset bulbs: and in the former way many fine new varieties have been produced. Extraordinary medicinal virtues were formerly ascribed to the bulb of *gladiolus communis*, one of the European species, found as far n. as Frankfort-on-the-Oder. The Hottentots eat the bulbs of some of the species, which contain a considerable quantity of starch.

GLA'DOVA, a small t. or village in the principality of Servia, on the Danube, immediately below the "Iron Gate," or rapids of that river, 110 m. e. of Belgrade. The place is of little importance, except as being the chief quarters of the Danube steam navigation company, its inhabitants conveying merchandise by land betwixt it and Orsova, about 13 m. further up the river. About 2¼ m. below it are the remains of the bridge built by Trajan across the Danube.

GLADSTONE, The Right Hon. WILLIAM EWART, statesman and orator, the fourth son of sir John Gladstone, Bart., of Fasque, in Kincardineshire, was born Dec. 29, 1809, at Liverpool, where his father, originally of Leith, had won eminence and wealth as a West India merchant. Gladstone was sent to Eton, and afterwards to Christ church, Oxford, where he closed a brilliant college career by taking a double first-class degree in 1831. He entered the house of commons in 1832 for the borough of Newark. He held the post of lord of the treasury, and afterwards that of under-secretary of state for the colonies in the Peel government for a few months in 1835. In 1838, he published his first work, *The State in its Relations with the Church*, which gave occasion to Mr. Macaulay to describe him, in a celebrated review of his work, as a "young man of unblemished character, the rising hope of those stern and unbending tories" who followed sir Robert Peel, while they abhorred his cautious temper and moderate opinions. In 1841, Gladstone became vice-president of the board of trade in the Peel administration, and in 1843, president of the board. Next to his chief, he took the most prominent part in the revision of the tariff and reduction of import duties, which reached their natural development in the repeal of the corn laws. He resigned office in Feb., 1845, when sir R. Peel proposed to increase the endowments of the college of Maynooth, a proposal at variance with all the principles laid down by Gladstone in his work. He rejoined the ministry in Dec., 1845, succeeding the earl of Derby (who refused to be a party to the repeal of the corn laws) as colonial secretary. He rendered sir R. Peel eloquent and effective aid in carrying the great measure of free trade through the house of commons, but paid the penalty in the loss both of his office and his seat, for the then duke of Newcastle, claiming to "do what he liked with his own," refused to sanction his re-election for Newark. In 1847, he was elected M.P. for the university of Oxford, which he continued to represent for 18 years. During a visit to Naples in 1850, he was induced by curiosity to attend the trial of M. Poerio, who was sentenced to several years' imprisonment, and subjected to indignities and cruelties which roused the generous indignation of the English statesman. The dungeons of the kingdom of the two Sicilies at this period swarmed with political prisoners, and Gladstone, in a letter to the earl of Aberdeen, made all Europe ring with the story of their sufferings and their wrongs. He after that advocated the cause of Italian independence in many eloquent speeches. In 1851, he opposed the ecclesiastical titles bill, brought in by lord J. Russell, thinking that no legislation was necessary, and that the act savored of religious persecution. After refusing an offer to hold office under lord Derby, he became chancellor of the exchequer in the coalition government formed by the earl of Aberdeen in 1852. This may be regarded as the turning-point in Gladstone's political career. Hitherto, he might be described as a tory or a Peelite; henceforth he is a liberal. When the Aberdeen government fell before a motion in the house of commons for inquiring into the state of the army before Sebastopol, Gladstone continued for a brief period a member of the cabinet of lord Palmerston, but soon retired, from an unwillingness to consent to the appointment of the Sebastopol committee. Gladstone then went into opposition, and in 1857 made an eloquent and damaging speech on Mr. Cobden's motion condemnatory of sir John Bowring's proceedings in China, which brought about the defeat of lord Palmerston, and the dissolution of parliament. In 1858, Gladstone accepted a special mission of importance to the Ionian islands. In the same year, he published an elaborate work on *Homer and the Homeric Age*, in 3 vols. In the second Palmerston administration, he resumed the post of chancellor of the exchequer. In 1860, he carried through parliament a commercial treaty with France, which, while it lasted, largely increased the trade between the two countries. His financial scheme that year involved

among other proposals the abolition of the paper-duty, which was strongly but unsuccessfully opposed in the house of commons. In the upper house, the paper-duty repeal bill was thrown out on financial grounds. Gladstone boldly denounced this interference with the taxing privileges of the commons. In 1861, he incorporated the repeal of the paper-duty in the financial scheme of the year, and had the satisfaction of witnessing the removal of the last obstacle to the dissemination of knowledge. Relations with the university constituency had now become so menacing, that in 1861 s. Lancashire asked him to stand as a liberal candidate. This he refused at the time; but, rejected by a majority of his academic constituency at the general election in 1865, he was returned by s. Lancashire third on the poll. In 1866, Gladstone, now leader of the house of commons, brought in a reform bill, the defeat of which caused earl Russell to resign. At the general election in 1868, s.w. Lancashire rejected, and Greenwich returned him. Acceding to office as first lord of the treasury at the close of that year, Gladstone, in 1869, disestablished the Irish church; in 1870, carried his Irish land bill; in 1871, abolished, by the exercise of the royal prerogative, purchase in the army; and in 1872 carried the ballot bill. In 1874, Gladstone dissolved parliament, and, on the unfavorable result of the ensuing election, the Gladstone ministry resigned. Gladstone was re-elected for Greenwich. In 1875, he retired from the formal leadership of the liberal party in the house of commons. Next year he denounced the Turkish cruelties in Bulgaria. Recent works of Gladstone's are *Juventus Mundi, the Gods and Men of the Heroic Age* (1869); *Rome and the Newest Fashions in Religion* (1875); and *Homeric Synchronism* (1876).

GLADSTONE, WILLIAM EWART, (*ante*), after his retirement in 1875 from the leadership of the liberal party, still showed himself, both in and out of parliament, alive to the questions, moral and political, which occupied the attention of his countrymen. Especially did he protest against the course pursued by the Beaconsfield ministry in regard to the war between Russia and Turkey, and also in relation to the affairs of India. It was largely through his influence that a public sentiment was at length formed against Beaconsfield's policy, which led to the dissolution of parliament, and a new election in the spring of 1880, in which the liberals triumphed by a large majority. Mr. Gladstone was thereupon placed once more at the head of the government, where he still remains. In 1879, he published *Gleanings of Past Years.*

GLADWIN, a co. in n. central Michigan, reached by the Jackson, Lansing, and Saginaw railroad; 570 sq.m.; pop. '74, 265. Its surface is uneven, and thus far but little cultivated. Co. seat, Gladwin.

GLAGOL, GLAGOLITZA, GLAGOLITES, an ancient Slavonic alphabet, principally used in several Roman Catholic dioceses of Istria and Dalmatia, in the psalms, liturgies, and offices of the church. Among these Illyrian adherents to the communion of Rome, mass is not celebrated in Latin, but in an ancient Slavonic dialect, written in this peculiar alphabet, the invention of which is popularly attributed to St. Jerome. The use of this liturgy was confirmed to the priesthood by a bull of pope Innocent IV., 1248. Of the antiquity of this alphabet the savants have maintained a great variety of opinions. Dobrowsky laid the foundation of a critical investigation of the subject, and has been followed by Kopitar, Jacob Grimm, Ivan Preis, etc. A Glagolitic MS. of the 11th c., belonging to count Kloz, published under the title of *Glagolita Clozianus* (Vienna, 1836), proves a higher antiquity than some had been willing to allow. Grimm supposes the Glagol alphabet very ancient, from its Runic character; but Preis thinks it more modern than the Cyrillick. The name Glagol is supposed by Kopitar to have been taken from the word *glogolati*, which frequently occurs in the liturgies, and which, though unknown to the Servo-Croatians, signifies in the ecclesiastical idiom, *to speak.* Glagol means *word* or *speech.*

GLAISHER, JAMES, b. England, 1800; a meteorologist and aeronaut; the man who has gone furthest from the surface of the earth. His remarkable ascent to 37,000 ft. (very near 7 m.), is recorded as the greatest effort of balloon ascension. He is a fellow of the royal society, and succeeded admiral Fitzroy as president of the meteorological department of the board of trade. His principal work is *Travels in the Air, a Popular Account of Balloon Voyages and Ventures, with Recent Attempts to Accomplish the Navigation of the Air.*

GLAMORGANSHIRE (in Welsh, *Gwlad Morgan*), the most southerly of the counties of Wales, is bounded on the s. and s.w. by the Bristol channel, on the w. by the co. of Cærmarthen, on the n. by Brecknock, and on the e. by Monmouth. Area, 547,070 acres; pop. '61, 317,752; '71, 397,859. The increase in population since 1801 is unexampled in the kingdom, being upwards of 460 per cent. The coast-line, following the principal windings, is about 90 m. in length, and its irregularities occur chiefly in the western portion of the county, and are formed by Swansea bay and the peninsula of Gower (q.v.). The whole of the northern district is covered with mountains, the highest of which, however, Llangeinor, is only 1859 ft. in height. This district comprises one of the richest coal-beds in the kingdom. The southern portion of the county, called the "Vale of Glamorgan," forms a great level, is richly wooded, with a mild climate, and is by far the most fertile part of South Wales. Its soil is a reddish clay, resting on lime-

stone, and is excellently adapted for the growth of cereals. The mountainous district is intersected by numerous picturesque valleys, affording good pasturage for sheep and cattle. The chief rivers are the Rumney, the Taff, the Neath, the Tawe, and the Llwchwr—all of them running southward from the mountains into the Bristol channel. Besides coal, anthracite or stone-coal, and coking-coal, with iron-stone and lead, are found in greater or less quantity. The ironworks at Merthyr-Tydvil are probably the most extensive in the world, and there are many others of scarcely less importance throughout the county. At Neath and Swansea are large copper-smelting works, to which ore is brought from South America and Australia. Lead and tin ores are also brought from considerable distances to this county to be smelted. Wheat, barley, oats, and potatoes are the chief crops raised; and butter and cheese are largely produced. The farms, however, are generally small, and agriculture is in a backward state. Owing to the immense development of the coal and iron works, the map of the county has of late years become a network of railways and tramways, and no part of the country is better supplied with means of transport. Glamorganshire sends two members to the house of commons, and the represented boroughs are Merthyr-Tydvil, which returns two, and the districts of Swansea and Cardiff, which have one member each. Glamorganshire contains some interesting Roman remains, and many memorials of the middle ages. Of these, Oystermouth castle, Cærphilly castle, Cardiff castle, and Margam abbey, are the finest remaining specimens.

GLANCE (Ger. *Glanz*), a term often applied in popular language, and also by mineralogists, to a numerous order or family of minerals, of which *galena* (q.v.) or *lead-glance* may be regarded as a type. All of them are metallic, and many of them are known by names indicating the metal which is their principal constituent, as *lead-glance*, *silver-glance*, *bismuth-glance*, etc. In these and many other species, the metal is combined with sulphur, so that the mineral is a sulphuret, but there are also numerous species of glance in which sulphur is not present, but selenium, arsenic, or tellurium takes its place. In some kinds also, two or more metals are present instead of one, in combination with one or the other of these non-metallic or semi-metallic substances. Thus, *gold-glance*, or *silvanite*, consists of gold and silver in combination with tellurium: it occurs in veins in porphyry, in Transylvania, and is wrought for the sake of both the precious metals which it contains. Several kinds of glance are very valuable ores, as *lead-glance*, or *galena*, *copper-glance*, or *redruthite*, and *silver-glance*, or *argentite*. Although mineralogists have adopted the names *pyrites*, *glance*, and *blende* as names of orders or families, the limits and distinctions of these groups are not well marked. All kinds of glance are fused without much difficulty by the blowpipe. They are also soluble in acids.

GLANCE-COAL. See ANTHRACITE and COAL.

GLANDERS is a malignant disease of the equine species, characterized by the appearance within the nostrils of little holes or ulcers, remarkable for their rugged, inflamed, undermined edges, their discharge of sticky, greenish, unhealthy pus, their tendency to spread, and their resistance of treatment. The blood of glanderous subjects is deficient in red globules, contains an excess of albumen and fibrine, and in this vitiated and deteriorated state is inadequate properly to nourish the body, which consequently becomes weak and wasted. The mucous membranes are also irritable and badly nourished; there is consequently impaired respiration, an obstinate choking cough, and relaxed bowels. The lymphatic glands and vessels become inflamed, and in their swollen state may be distinctly felt about the throat and underneath the jaws, and also in the limbs, where they frequently run on to ulceration, constituting farcy (q.v.). Glanders is produced by any cause which interferes with the purity or integrity of the horse's blood, or produces a deteriorated or depraved state of his system. It has been frequently developed in healthy animals by their breathing for a short time a close, impure atmosphere, and cases of this sort were thus produced amongst the horses of several of our cavalry regiments, whilst being transported in badly-constructed, overcrowded vessels to the Crimea in 1854. Confined, overcrowded, badly ventilated stables are almost equally injurious, for they prevent the perfect aëration of the blood, and the prompt removal of its organic impurities. Bad feeding, hard work, and such reducing diseases as diabetes and influenza, also rank amongst the causes of glanders. A small portion of the nasal discharge from a glandered horse coming in contact with the abraded skin of man, communicates the loathsome and fatal disease from which so many attendants of horses have died, and government, by the act Vict. 16 and 17, of date Aug. 14, 1853, very properly compels the immediate destruction of every glandered horse. Whilst oxen and dogs are exempt from it, donkeys suffer generally in the acute form, often dying in eight or ten days. Horses frequently have it in a chronic form, and if well fed and managed, sometimes live and work for years. In the old coaching-days, some stages were known to be worked by a glandered team, but no animal with glanderous ulcers or discharge should on any account be preserved, for, besides being perfectly incurable, the fatal disease is communicable not only to healthy horses, but also to human beings. See EQUINIA.

GLAN'DFORD BRIGG, or BRIDGE, a market t. of England, in the parish of Lindsay, in the co. of Lincoln, and 22 m. n.n.e. of the city of Lincoln, on the navigable river

Ancholme, which falls into the Humber, about 10 m. from Glandford Brigg. It is a station on the Sheffield and Lincolnshire branch of the Great Northern railway. The town is clean and regularly built, has a handsome modern church with a lofty spire, several other places of worship, a corn exchange, schools, etc. Its free grammar-school was founded in 1669. A considerable trade is carried on, by means of the Ancholme, in corn, coal, and timber. The town relies mainly for its prosperity on the corn market, which is one of the best in the county. The corn exchange is a large building, admirably adapted for the purpose for which it was erected. Formerly a large business was done in the dressing of hare and rabbit skins for the use of hat manufacturers, but there was in 1867 only one establishment of the kind remaining. Pop. '71, 2,646.

GLANDS are divided by anatomists into two great classes, viz., true secreting glands and ductless glands.

The first class constitute special organs which are destined for the production of the chief secretions; as, for example, the lachrymal, mammary, and salivary glands, the liver, pancreas, kidneys, etc.; while the suprarenal capsules, the spleen, the thymus, and the thyroid belong to the second class.

An ordinary secreting gland consists of an aggregation of follicles, all of which open into a common duct, by which the glandular product is discharged. The follicles contain in their interior cells (q.v.), which are the active agents in the secreting process; while their exterior is surrounded by a net-work of capillaries, from whose contents the materials of secretion are extracted.

The simplest form of a gland is the inversion of the surface of a secreting membrane into follicles, which discharge their contents upon it by separate mouths. Of this we have examples in the gastric glands and follicles of Lieberkühn described and figured in the article DIGESTION. Dr. Carpenter very well exhibits the commencement of the progressive complication which is observed in most of the glandular structures occurring in man and the higher animals.

The articulata (for example, insects) present glandular structures which can be unraveled much easier than the glands of vertebrate animals; and the forms, in all of which a large amount of secreting surface is presented in comparatively little space, are often very graceful.

To understand the structure of a complex gland like the liver or kidney, it must be followed from the simplest form in which it is known to occur through its various degrees of complication. In this way the liver may be traced, from the lowest mollusca (where it exists as simple follicles, lodged in the walls of the stomach, and pouring their product into its cavity by separate orifices) up to man, in whom it is an organ of extreme intricacy; and similarly in the early fetal state of the higher animals, the liver and other secreting organs more or less resemble the persistent state of those parts in animals lower in the animal scale. In the same way, the mammary gland (q.v.), which is a structure of considerable complexity in the higher mammals, presents a very simple arrangement in the lowest type of this class, the ornithorhynchus, being merely a cluster of cæcal follicles, each of which discharges its contents by its own orifice.

Sometimes a gland has several ducts (as, for example, the lachrymal gland), but, as a general rule, the most important glands have only a single canal, formed by the union of the individual ducts, which conveys away the product of the secreting action of the whole mass.

Whatever be the complexity in the general arrangement of the elements of a gland in the higher animals, these elements are always found to resolve themselves into *follicles* or *tubuli*, which inclose the true secreting cells.

The second class of glands resemble the secreting glands in external conformation, and in the possession of a solid parenchymatous tissue, but differ from them in the absence of a duct or opening for the removal of the products of secretion; and indeed, except in the case of the thymus, no material resembling a secreted product is yielded by any of them. In all of them, the tissue mainly consists of cells and nuclei, with a great abundance of blood-vessels. They may probably be regarded as appendages to the vascular system; and from the absence of any excretory duct, they have received the name of *vascular ductless glands*.

The *lymphatic glands* belong to a different class of structures, and will be described in the article on the LYMPHATIC SYSTEM.

GLANDS, DISEASES OF. The lymphatic glands are subject to enlargement from acute inflammation and abscess, usually in consequence of irritation of the part from which their lymphatics spring, as in the case of scarlet fever, in which the glands of the throat are affected; in gonorrhœa, the glands of the groin, etc. The treatment of such abscesses belongs to the ordinary principles of surgery. See ABSCESS. A much more troublesome affection of the glands is the slow, comparatively painless, at first dense, solid swelling which they undergo in scrofula (q. v.), which tends very slowly, if at all, to suppuration, and sometimes remains for years. In syphilis (q. v.) and cancer (q. v.), there are also enlargements of the lymphatic glands. Scrofulous or tubercular disease of the mesenteric glands in children constitutes tabes mesenterica (q. v.). The larger glands, as the liver, kidney, pancreas, spleen, thyroid, thymus, testicle, and even

the pituitary gland, have all their special diseases, which will be noticed, so far as necessary, in treating of these organs.

GLANVILL or GLANVIL, JOSEPH, 1636–80; was educated at Oxford university, where he graduated in 1658. In 1666 he obtained the cure of Abbey church at Bath; in 1678 he became prebendary of the church of Worcester, and acted as chaplain-in-ordinary to Charles II. He wrote *The Vanity of Dogmatizing, or Confidence in Opinions, manifested in a Discourse of the shortness and uncertainty of our Knowledge, and its Causes, with Reflections on Peripateticism, and an Apology for Philosophy* (1661); *Philosophical Considerations concerning the existence of Sorcerers and Sorcery;* a comedy entitled *the Drummer;* and *Sadducismus Triumphatus.*

GLAN'VILLE. The earliest treatise on the laws of England, *Tractatus de Legibus et Consuetudinibus Angliæ*, is written by Glanville. Of this work, prof. Robertson says (*Hist. of Charles V.*), that it is supposed to have been the first undertaking of the kind in any country in Europe. It was composed about 1181. The author is generally supposed to have been Ranulphus de Glanville, chief-justice in the reign of Henry II. Sir Matthew Hale, while he admits the date of the work to have been in the reign of that monarch, appears to hesitate to ascribe the authorship to the chief-justice. Lord Campbell (*Lives of the Chief-Justices*, i. 25) remarks that Glanville, in some points, is still of authority, "and may be perused with advantage by all who take an interest in our legal antiquities. This author is to be considered the father of English jurisprudence. Bracton, who writes in the following century, is more methodical, but he draws largely from the Roman civil law, and is often rather speculative; while Glanville actually details to us the practice of the aula regis in which he presided, furnishes us with a copious supply of precedents of writs and other procedure then in use, and explains with much precision the distinction and subtilties of the system which, in the fifth Norman reign, had nearly superseded the simple juridical institutions of our Anglo-Saxon ancestors." This work was first printed in the year 1554, at the instance of sir W. Stanford, a judge of the Common Pleas. The treatise of Glanville closely resembles the Scottish *Regiam Majestatem* (q. v.). "The latter," says Coke (*Inst.* iv. 345), "doth in substance agree with our Glanville, and most commonly *de verbo in verbum*, and many times our Glanville is cited therein by special name." A dispute has arisen, in consequence of this close similarity, as to which country shall claim the honor of producing the original work. Mr. Erskine does not hesitate to claim the distinction for Scotland; but lord Stair, following the opinion of Craig, frankly admits "that those books, called *Regiam Majestatem*, are no part of our law, but were compiled for the customs of England, in thirteen books, by the earl of Chester, and by some unknown and inconsiderate hand stolen thence, and resarcinate in those four books which pass amongst us" (Stair, i. 1, s. 16).

GLA'RUS, a canton in the n.e. of Switzerland, is triangular in shape, and is bounded on the n.e. by the canton of St. Gall, on the s.e. by that of the Grisons, and on the w. by those of Schwyz and Uri. It has an area of 262 sq.m.; and in 1876, it had 36,362 inhabitants, of whom near 7,000 were Catholics, the others almost all Calvinists. The surface is mountainous, the highest peak being that of Tödiberg or Dödiberg in the s.w., which reaches a height of 11,880 feet. From the foot of this mountain, the Linth, the chief river, flows n.n.e., through the middle of the canton, and empties itself into the lake of Wallenstadt. The principal valleys, after that of the Linth, are the Sernfthal and the Klönthal, both formed by tributaries of the Linth. The climate is very severe, and only one-fifth of the land is arable. This canton, in which the rearing of cattle was formerly the main pursuit of the inhabitants, is now an important manufacturing district. The principal manufactures are cotton, woolen, muslin, and silk goods, and paper and slates. Great part of the manufactures are exported to the east, to n. Africa, America, and China. The green cheese called schabziger, which is wholly made here, and other agricultural products, are exported. In none of the Swiss cantons does the population so slowly increase as in that of Glarus. The old homely manners, and many even of the customs of antiquity, still prevail among the people. In the earliest times, Glarus was reckoned sometimes as a part of Rhœtia, sometimes as a part of Swabia, and was peopled by German settlers. After various changes, it passed into the possession of the dukes of Austria, but ultimately secured its independence by the victories of Näfels in 1352 and 1388, when it joined the Swiss confederation. The chief town is Glarus, with a large Gothic church which serves both for Catholics and Protestants and in which Zwingli was parson from 1506–16. Pop. '70, 5,516.

GLAS, JOHN. See GLASSITES, *ante*.

GLASCOCK, a co. in e. Georgia, on the Ogeechee river; 225 sq.m.; pop. '70, 2,736—819 colored. The surface is generally level; productions, wheat, corn, and cotton. Co. seat, Gibson.

GLASGOW, the industrial metropolis of Scotland, is one of the largest and most important cities in the kingdom. It is situated on the Clyde, in the lower ward of Lanarkshire, and occupies chiefly the n. side of the river, but has large and populous suburbs on the s. side. The river is crossed by seven bridges. Two of granite and one of iron are much admired for their light and graceful architecture. Two are suspension-

bridges; and two are the viaducts of the Union and the Caledonian railways. Below the bridges ferry-boats ply at all hours.

The ground upon which Glasgow is built is, for the most part, level, but in the n. and n.w. districts, there are considerable elevations. Owing to the number of cotton-factories, chemical works, foundries, and work-shops of all kinds, the city has a somewhat dingy and smoky aspect; while many of the streets are continually thronged with passengers, and noisy with carts, cabs, and omnibuses. In other respects, it has many attractions. The houses facing the river stand well back, leaving spacious thoroughfares on each side, and affording full and noble views of the bridges, of several handsome street ranges and public buildings, and of the harbor with its steaming funnels and forests of masts. Most of the leading streets run from e. to w., parallel with the river, and almost all the streets, except in the oldest parts of the city, are laid off in straight lines. The houses are generally lofty, and built of freestone, the floors of each tenement being usually occupied by separate families, entering by a common stair. In the fashionable quarters, "self-contained" houses prevail. Glasgow has comparatively few squares or other open spaces, but it has four public parks—one in each quarter of the city—namely, the Green (140 acres), occupying the level next the Clyde at the e. end; Queen's park (upwards of 100 acres), finely situated on a rising-ground to the s.; Kelvingrove, or West End park (40 acres), rounding the face of a hill crowned with noble terraces, and sloping down to the Kelvin, at the w. end; and the Alexandra, or north-eastern park (85 acres). The city is about 3 m. in length from e. to w., and is about 8 m. in circumference.

Glasgow had its first nucleus in the cathedral, and afterwards in the university. The former is situated in the n.e. of the city, on a height on the banks of the Molendinar stream, which runs between the old burying-ground and a steep rocky eminence formerly known as the Fir park, but now transformed into the Necropolis, a modern cemetery, studded and crowned with monuments. It is from this ravine that the name Glasgow is supposed to have been derived, etymologists professing to find in it two Celtic words signifying a "dark glen." St. Kentigern, or St. Mungo, founded a bishopric on the banks of the Molendinar about 560; but for more than 500 years afterwards, the history of the place is a blank. About the year 1115, David, prince of Cumbria (afterwards king of Scotland), restored the see, and appointed his preceptor, John, to the bishopric, who laid the foundations of a cathedral, which was replaced by the present pile, founded by bishop Jocelin in 1181. In 1180, king William the Lion erected Glasgow into a burgh, with the privilege of an annual fair; but for a century and a half later, it continued an insignificant town of not more than 1500 inhabitants. In 1345, bishop Rae built the first stone bridge across the Clyde; and in 1451, bishop Turnbull established the university, having obtained a bull for that purpose from pope Nicholas V. The latter event gave a considerable impetus to the place, yet, in 1556, Glasgow only ranked eleventh in importance among the towns of Scotland.

The city as it now exists is almost wholly modern, having quintupled in dimensions during the last 70 years. This immense growth has arisen from its situation in the midst of a district abounding in coal and iron, and from the facilities afforded by the Clyde for the cultivation of a world-wide commerce. At the same time, it must be admitted that much of its prosperity is due to local ingenuity and enterprise. It was here that James Watt, in 1765, made his memorable improvement on the steam-engine; it was here that Henry Bell, in 1812, first (in the old world) demonstrated the practicability of steam navigation. An enormous sum has been expended on the widening and deepening of the river, now navigable by vessels 300 ft. long, and drawing 23 ft. of water. The Queen's docks at Stobcross, opened in 1877, have a depth of 20 ft. of water, and an area of 34 acres, and have cost £1,600,000. The enterprising spirit of the inhabitants began to manifest itself during the 17th century. Sugar-refining, the distillation of spirits from molasses, and the manufacture of soap, were among their earlier industries. The opening up of the American colonies to Scotch enterprise after the union gave an immense increase to its commerce. Glasgow became the chief emporium of the tobacco trade, and its Virginian merchants formed a local aristocracy, remarkable for wealth and *hauteur*. This trade was at length paralyzed by the American war; but sugar cultivation in the West Indies, and the introduction of the cotton manufacture, opened up new paths to opulence. Calico-printing, Turkey-red-dyeing, beer-brewing, and other branches followed; and with the rapid expansion of the iron trade, including machine-making and steamboat-building, the city has attained its present magnitude. Among its thousand chimney-stalks, there is one of near 460 and one of about 440 ft., being the highest in Britain. The latter carries aloft the noxious vapors of St. Rollox, the largest chemical works in the world, covering 12 acres of ground, and employing upwards of 1000 men.

In all that relates to lighting, paving, sewerage, and the like, Glasgow deserves laudatory mention. The city is governed by a lord provost, 9 bailies, and 47 councilors, to whom are added the dean of guild from the merchants', and the deacon-convener from the trades' house. The sheriff, five sheriff-substitutes, and a stipendiary magistrate exercise within the city a co-ordinate jurisdiction with the civic magistrates, and preside over various civil and criminal courts. Much of the spirit which characterizes the manufacturing and commercial affairs of Glasgow has been carried into its municipal

arrangements. Corporation halls, comprising a valuable gallery of paintings, have been secured for the citizens; public parks have been purchased at great cost, and laid out in a style of unsurpassed beauty; and a supply of water has been introduced from loch Katrine at the bountiful rate of 32,003,000 gallons a day. Glasgow has (1878–79) 61,069 registered parliamentary voters, and sends three members to the house of commons.

Many of the public buildings deserve notice. The cathedral, which has recently been restored and enriched with stained glass, chiefly from Munich, is one of the finest first pointed churches in the kingdom. The royal exchange in Queen street, several of the banks, and many of the churches, likewise present fine specimens of architecture in a variety of styles. Glasgow has several equestrian statues, including those of William III. at the cross, the duke of Wellington in front of the royal exchange, and queen Victoria in George's square. The last two are by Marochetti. In the green there is an obelisk, 144 ft. high, to Nelson, forming a conspicuous object in the landscape. In George's square there are a column surmounted by a statue of sir Walter Scott; a fine statue of sir John Moore, by Flaxman; one of James Watt, by Chantry; one of sir Robert Peel, by Mossman; and statues of Robert Burns and Thomas Campbell, erected in 1877. A marble statue of Pitt, by Flaxman, stands in the corporation galleries. The new public halls, opened in 1877, are spacious and elegant. Charitable institutions and benevolent societies abound. There are several theaters and museums, and numerous halls in which soirées and concerts are held almost nightly during winter. The wealthier inhabitants migrate to the coast in shoals during the summer, and cheap Saturday excursions by river and rail are extensively taken advantage of by the working classes. To the n.w. of the city is a botanic garden of about 40 acres, which is thrown open every summer, during the fair holidays, at a merely nominal charge. With the additional and recent attraction of the Kibble conservatory, large numbers visit these gardens. Besides the Necropolis, there are several other garden cemeteries in the vicinity, of which Sighthill is the most picturesque. The Andersonian university, a college for the unacademical classes, is described under ANDERSON, JOHN.

The Caledonian, the North British, and the Southwestern railways have each a terminus in Glasgow. A union railway to connect the various stations on the n. and s. sides of the river was projected, and its large handsome terminus has been opened for traffic; but the Caledonian is constructing a separate central station for its own use. Glasgow has six daily, and twice as many weekly newspapers. It has about 300 churches and chapels; and is most liberally supplied with schools of all degrees and for all classes of society. Pop. '01, 83,769; '61, 446,639; '71, 477,710; including suburbs, 566,150.

GLASGOW, THE UNIVERSITY OF, was founded in 1451 by bishop Turnbull, who procured a bull of ratification from pope Nicholas V. In 1460, James, first lord Hamilton, endowed a college on the site—in the densest part of the High street—of the late buildings, the older portions of which were erected between 1632 and 1656. Queen Mary bestowed on the university 13 acres of adjacent ground. In 1577, James VI. granted increased funds in a new charter. In 1864, the university buildings and adjacent lands were sold, and handsome new buildings, designed by sir G. Gilbert Scott, were erected on the bank of the Kelvin, overlooking the West End park, which were formally opened n 1870. The total cost (of which £150,000 have been subscribed in Glasgow, etc., and £126,000 promised by parliament) is estimated at about £470,000.

Chairs, Office-bearers, Degrees.—The office-bearers of the university consist of chancellor, rector, principal, and dean of faculties. The chancellor holds his office for life, and was formerly elected by the senate, but since 1875 he is elected by the general council; the rector is elected triennially by the matriculated students, who are divided, according to their place of birth, into four nations—*Glottiana* (Lanarkshire), *Transforthana* (Scotland n. of the Forth), *Rothseiana* (Buteshire, Renfrewshire, and Ayrshire), *Loudoniana* (all other places). The dean of faculties is elected annually by the senate. The duties of chancellor and rector are chiefly honorary. The chairs are Latin, Greek, mathematics, logic, natural philosopy, moral philosophy, English language and literature, anatomy, physiology, materia medica, practice of physic, natural history, chemistry, clinical surgery and medicine, midwifery, botany, surgery, medical jurisprudence, institutes of medicine, oriental languages, divinity, church history, biblical criticism, civil law, conveyancing, civil engineering, and practical astronomy. The degrees granted are master of arts, bachelor of science, doctor of medicine, master of surgery, bachelor of divinity, bachelor of law, bachelor of laws, doctor of divinity, and doctor of laws, the last two being honorary. The ceremony of graduation was of old conducted with no little pomp through all its stages, from its beginning in what was called "the black stone examination," to its close in the act of "laureation" in the college hall, or one of the city churches. The number of matriculated students in 1870–71 was 1279; in 1878–79 it was upwards of 2,000. The students reside outside the college walls; and those in the faculty of arts wear scarlet gowns.

Bursaries and Exhibitions.—There are nearly 190 bursaries for students still attending lectures, ranging in value from £6 to £80; and of exhibitions, fellowships, and

scholarships (besides 9 common to Glasgow with the other Scottish universities), there are 40. Of the latter the most valuable are the four Clark scholarships, founded in 1872, and each worth £200 a year. The oldest are the Snell exhibitions, founded by John Snell, a native of Ayrshire, who in 1677 presented to the university a landed estate, for the purpose of supporting at Balliol college, Oxford, ten students who had previously studied at Glasgow. Owing to the rise in the value of land, the foundation now maintains 14 exhibitioners, who each receive £110 a year for five years.

Libraries, Museums, etc.—The library was founded prior to the reformation, and now contains about 105,000 volumes. It is supported by an annual grant of £707 from the treasury, graduation fees, the contributions of students, etc. Subsidiary libraries are attached to several of the classes, the books being selected with a view to the subjects treated of in each class. In July, 1781, the celebrated Dr. William Hunter of London framed a will, leaving to the principal and professors of the university his splendid collection of coins, medals, and anatomical preparations; and for the accommodation and conservation of these, a building was erected in 1804, but they are now located in the new university. The university also possesses an observatory and a botanical garden, and several of the professors have collections of apparatus attached to their classes, illustrative of the courses delivered.

Eminent Professors and Students.—Among the men of eminence who have taught or studied in the university, are bishop William Elphinstone, John Major, John Spottiswoode, Andrew Melville, James Melville, Robert Boyd of Trochrig, John Cameron, Zachary Boyd, Robert Baillie; James Dalrymple, first Viscount of Stair; Gilbert Burnet, bishop of Salisbury; Dr. John Douglas, bishop of Salisbury; Dr. Robert Simson, Francis Hutcheson, Dr. William Hunter, Dr. James Moor, Dr. Adam Smith, Dr. Thomas Reid, Dr. William Cullen, Dr. Joseph Black, Dr. Matthew Baillie, prof. John Miller, Thomas Thomson, Francis Jeffrey, John Gibson Lockhart, sir William Hamilton, and arch. Tait, the present archbishop of Canterbury.

GLASS, from the Fr. *glace* (Lat. *glacies*), ice, which it resembles in its transparency. Glass is essentially a combination of silica with some alkali or alkaline earth, such as lime, barytes, etc. Generally speaking, it is understood to be a silicate of soda, or a combination of silica or flint with one or more of the salts of sodium, with the addition, for some purposes, of certain metallic oxides and other substances.

History.—The invention of glass dates from the earliest antiquity, and the honor of its discovery has been contested by several nations. As the oldest known specimens are Egyptian, its invention may with great probability be attributed to that people. It is mentioned as early as the 5th or 6th dynasty, and called *bashnu*, the Coptic *bijni;* and articles made of it are represented in the tombs of the period; while its fabrication is depicted in sepulchers of the 12th dynasty—i.e., about 1800, B.C. The glass of Egypt was generally opaque, rarely transparent, and alway colored, the articles made of it being of small size, and principally for adornment, as beads, vases, small figures, and objects for inlaying into wood or other material. Specimens exist of this glass, bearing the name of the queen Hatasu of the 18th dynasty, 1445, B.C., and vases of blue glass, with wavy lines in white, light-blue, yellow, black, red, and green, of that and a later age, have been discovered. The Egyptians also successfully imitated precious and other stones in glass—as emeralds, lapis-lazuli, turquoises, jaspers, onyx, and obsidian; for this purpose, they used nearly the same materials as at present, employing manganese, copper, iron, cobalt, gold, and tin. Transparent glass, indeed, does not appear earlier in Egypt than the 26th dynasty, about 750, B.C., when bottles and a few other objects—as figures for inlaying, and beads imitating gems—were made of it. According to Herodotus, the Ethiopians, two centuries later, placed their mummies in glass coffins; but the fact has never been proved by any as yet discovered.

Under the native Pharaohs, Egyptian glass seems to have been extensively exported to Greece and Italy, and its reputation still continued under the Ptolemies, when the furnaces of Alexandria produced glass vases of numberless shapes and considerable size. At this period, the Egyptians invented the *millefiori* glass, consisting of small threads of glass arranged vertically and then fused, so that the whole rod thus formed was of one pattern; and by cutting off slices, each piece reproduced the same pattern. The glass beads of *medrepore* glass, which are found in the tombs of Greece and Italy, and are formed by placings lices of such rods in a mold and fusing the whole, are probably of Egyptian or Phœnician origin. Egypt still retained the pre-eminence in the manufacture of glass under the Romans, the sand of Alexandria being indispensable for the finest qualities, and it exported glass to Rome. Hadrian, on his visit, was struck with the activity of the manufacture, and sent to his friend, the consul Servianus, one of the vases, called allosontes, or "opalescent;" and the Roman writers mention with admiration the melting, turning, and engraving of Egyptian glass. To the most flourishing period of the empire are to be referred certain vases and slabs with white camei figures of fine execution in relief on a blue background, and plates of opaque glass for inlaying the walls of rooms, such as those which are said to have decorated the mansion of the usurper Firmus. The art of glass-making, in fact, has never become extinct in Egypt, the Fatimite caliphs having issued glass coins in the 10th and 11th centuries, and beauti-

ful lamps of glass enameled on the surface with various colors having been made in the 14th century. Although the art of glass-making has fallen to the lowest ebb in Egypt, the workmen are said to manifest considerable aptitude in its production.

After the Egyptians, the people of antiquity most renowned for glass were the Phœnicians, who were the legendary inventors. Certain of their merchants, it is said, returning in a ship laden with natron or soda, and having been compelled by stormy weather to land on a sandy tract under Mt. Carmel, placed their cooking-pots on lumps of natron on the sand, which, fused by the heat of the fire, formed the first glass. Sidon, indeed, was long celebrated for her glass-wares made of the sand brought down from Mt. Carmel to the mouth of the river Belus. The nature, however, of the earliest Phœnician glass is unknown, unless the opaque little vases of the toilet found in the tombs of Greece and Italy, and the beads of the same discovered in the barrows and tumuli of the old Celtic and Teutonic tribes, were imports of the Phœnicians. The vases of Sidon were, however, highly esteemed at Rome under the Antonines, fragments of bowls of blue and amber glass, with the names of the Sidonian glass-makers, Artas and Irenæus, stamped in Latin and Greek, having been found in the ruins. Perhaps the Assyrian glass vases were made at Sidon; at all events, the earliest dated specimen of transparent white glass is the vase having upon it stamped or engraved in Assyrian cuneiform a lion and the name of Sargon, who reigned 722 B.C., found at Nimrud by Mr. Layard; and glass seems to have been imported or even made in Assyria as late as the time of the Parthians, when Nineveh became the Roman colony of Claudiopolis. Under the Sassanides, moulded glass vessels, elaborately decorated, were made, as is shown by the cup of Chosroes, 531–579 A.D., in the Louvre; and Persia continued to manufacture glass vessels in the middle ages. The Arabs seem to have derived their glass from the Byzantines, and specimens introduced into Europe by the Crusaders were called in royal and other inventories Damascus glass; this was colored, and not plain. Although the art of glass-making appears to have been practiced in remote times, this nation does not appear to have attained any proficiency in it, and is content at the present day to re-melt European glass; while some of its highest efforts do not exceed the imitation of jade, and other stones. There is still an extensive use of glass-beads in the east, which are chiefly made at Khalib or Hebron. Glass was equally unknown to the Hindus, except the production of a few trinkets and inferior objects, till the settlement of Europeans in India: and the country was, at the remotest period, supplied by Phœnician, and in the middle ages, by the Venetian traders. Although Josephus claims the invention of the art for the Jews, no remains of Jewish glass are known, and it is probable that the Jews were principally indebted for their supplies to the neighboring cities of Tyre and Sidon. Even in Greece itself, glass was by no means ancient. In the days of Homer it was unknown. Herodotus, indeed, mentions its employment for ear-rings, but these may have been of Phœnician make. It was called *hyalos*, crystal or ice, and *lithos chyte*, or fusible stone. Aristophanes, 450 B.C., mentions glass or crystal vessels, and various inscriptions confirm its use, but its value was next to gold, which could hardly have been the case if it had been of native manufacture. In the 4th c. B.C., Pausias, a celebrated painter, had depicted *Methe*, or "Intoxication," drinking from a transparent glass bowl which revealed her face. Glasses and plates, amphoræ and diotæ, large two-handled jars, were made of it, and also false stones for finger-rings, called *sphragides hyalenai*. These last, called by archæologists *pastes*, were imitations of engraved stones in colored glasses, used for the rings of the poorer classes, and were no doubt often copies or impressions of engraved stones of celebrated masters; false gems and camei having a subject in opaque white, sometimes like the sardonyx, with a brown layer superposed on the parts representing the hair, and the whole laid on a dark-blue ground, appear before the Christian era. Lenses were also made of glass, and the celestial sphere of Archimedes was made of the same material. The supposed Phœnician colored glass vases for the toilet, found in the oldest sepulchers of Greece, it must be observed, have Greek shapes. Glass-makers, *hyalopsoi*, *hyalepsæ*, are also mentioned at a later period, when there can be no doubt the art was practiced. Of the Alexandrian glass, mention has been already made; and the body of Alexander the Great was shown to Augustus in a glass coffin.

The glass-making art in Italy does not date earlier than the commencement of the Roman empire, importations from Sidon and Alexandria having previously supplied the want of native manufacture; but there is ample evidence of its extensive manufacture at that period, having been introduced in the days of the Ptolemies, large plates being used for incrusting chambers, *vitreæ cameræ*; and hollow columns made of this material, with lamps inside, were used to illumine the public theaters. As early as 58 B.C., the theater of Scaurus had been decorated with mirrors or glass plates, disposed on the walls. Glass was also used for paving, and for the blue and green tesseræ of mosaics (see MOSAIC). Window-glass does not appear till about the 3d c. A.D.; the houses at Herculaneum, destroyed in the reign of Titus, being glazed with talc, and some doubt remaining as to the use of glass for this purpose at Pompeii. Lactantius in the 3d c. A.D.; St. Jerome, 422 A.D., mention glass windows. Older windows of this material are said to have been found at Ficulnea, and even in London. Under the Romans, colored as well as white glass was extensively used; it had a greenish tint in the first days of the empire,

but had sensibly improved in color and quality in the days of Constantine. The first production of a white glass like crystal was in the days of Nero. Its use was most extensive, and it was either blown or stamped according to the objects required. Glass vases, *vasa vitrea escaria potoria*, are mentioned. So are costly cups of many colors, purple ones of Lesbos, and balsamarii, especially the kind long called lachrymatories, which held perfumes, medicine, drugs, and other substances like modern vials, amphoræ, ampullæ, pillar-molded bowls, bottles for wine (*lagenæ*). urns (*urnæ*) for holding the ashes of the dead, and pillar-molded bowls or cups (*pocula*).

Besides these articles of amusement and luxury, hair-pins, beads, rings, balls, draughtsmen, dice, knuckle-bones (*astragali*), mirrors, multiplying-glasses, prisms, magnifying-glasses, telescopes, and water-clocks were made of this material.

Many vases are stamped, and some, principally of square shape, have the initials and devices of their makers or contents, as eye-waters, impressed on the bottom. Most of the precious stones were successfully imitated in glass pastes; and the empress Salonina was egregiously cheated by a fraudulent jeweler. But the most remarkable works in glass are the camei vases (*toreumata vitri*); of which the most celebrated is the Portland vase in the British museum, a two-handled vessel about 10 in. high, of transparent dark-blue glass, coated with a layer of opaque white glass, which has been treated as a cameo, the white coating having been cut down, so as to give on each side groups of figures delicately executed in relief. The subject is the marriage of Peleus and Thetis, and the urn held the ashes of a member of the imperial family of Severus Alexander, who died 221–35 A.D. This emperor had imposed a tax upon glass. It was found in a magnificent sarcophagus in the Monte del Grano, near Rome. A vase of smaller size, but of similar fabric, with arabesques, found at Pompeii, exists in the Naples museum; and numerous fragments of even finer vases, some with five colors, exist in different museums. In the reign of Tiberius, an adventurer pretended that he had invented flexible glass, and threw down a vase which only bent, and which he readjusted with a hammer; he seems to have connected it in some way with the philosopher's stone, and the emperor is said to have banished him or put him to death. This invention is said to have been twice reinvented in modern times—once by an Italian at the court of Casimir, king of Poland. In the 3d c. A.D. appeared the *diatreta* or "bored vases," consisting of cups (*pouela*) having externally letters, and net-work almost detached from the glass, but connected by supports; all which must have been hollowed out by a tool, involving great labor. One vase of this class, bearing the name of Maximianus, who reigned 286–310 A.D., fixes their age. At a later period, bowls of engraved glass, having subjects of gladiatorial fights, came into use. Still later, apparently in the 5th c., a new style of glass ornamentation was introduced, consisting of the figures of Christ and legends of saints, and the portraits of private persons laid on in gold upon one layer of glass, over which was placed another, through which they appeared. At the close of the Byzantine empire, the glass art was still rich and ornamental. Achilles Tatius describes a vase which, when filled with wine, made the portion representing the bunches of grapes seem red, as if ripened by the autumn. The numerous beads called serpents' eggs or adder stones (*glain nerdryr*), found throughout Roman Britain, were imported by route of Gaul to Britain, or made in Britain. Glass was cheap under the Roman empire, and Strabo informs us that in his days in Rome a glass cup and saucer only cost an *as* (about a half-penny). Such articles, indeed, can only have been of the commonest kind, as Nero is said to have paid 6,000 sesterces, or about £50,000, for two cups of moderate dimensions. Aurelian made the Alexandrians pay a tax of glass. A peculiar white glass seems to have been made at Carthage under the Roman empire. Glass gems for rings (*vitreæ gemmæ*) were in most extensive use. Glass, however, was considered always something costly and rare, and is mentioned as such in the *Revelations* and in the *Recognitions of St. Clement*, in which St. Peter is described as praying to see some marvelous columns of this material in the island of Aradus. At the close of the Roman empire, only two kinds of glass appear to have been manufactured—bottles of a greenish glass in the west, and the *hyalina diachrysa*, or gilded glass of many colors, in the east. After that period, a few glass vessels have been found in the Anglo-Saxon graves of England, and Frankish sepulchers of France, of a peculiar fabric of green glass with projecting knobs, bent round to the body of the glass, and apparently a rude imitation of the *diatreta*. The Romans knew the use of soda and lead as fluxes for glass, and made both crown and flint glass. They made most of the fancy varieties at present in use, and were acquainted with the art of coloring it blue by cobalt, green by copper, rose or ruby by gold. Many of their imitations of gems and other fanciful colors were also of *schmeltz* glass. But the great site of the glass manufactories of the dark and middle ages was Venice, whither it was transplanted on the foundation of that city in the 7th c. A.D. The art, however, seems to have improved on the conquest of Constantinople by the French in 1204, and in 1291 the establishments were removed to the island of Murano, the manufacturers forming a guild with a libro d'oro, or register of nobility, and the secret kept with the greatest jealousy. In 1486, their color-glass came into note, and continued so till the close of the century; and in the 16th c., lace-patterns and mirrors were introduced. In the 15th and 16th centuries, plain glass with nice ornaments gilt and enameled; in the 16th, crackled lace and reticulated glass, *vitrodi trino;* and in

the 17th c., variegated or marbled glasses were produced. The *millefiori* glass extends through all periods, and seems to have been derived from the Roman, being continued to the present day, when large quantities of this glass are annually imported to England, and transported to Africa and Asia in the way of trade. The Venetian glass engaged for a long time the monopoly of commerce, their mirrors, goblets, and cups being exported all over the world, but it has been superseded by manufactures of England and Germany. The forms of the Venetian glass reflected its oriental origin, and the earlier glass of other countries of Europe in their turn show the derivation of their art from Venice. In Germany, the oldest glass (which was flint) dates from the 16th c., and consists of goblets and tankards of white color, enameled with colored coats of arms and other devices, milleflori, and schmeltz glass. Engraved glass was first introduced by Caspar Lehmann, at Prague in 1609 under imperial protection, and continued by his pupil G. Schwanhard; and ruby glass by Kunckel in 1679. Glass is said to have been made in 1294 at Quinquengrone, in Normandy, before the 16th c., in the reign of Philip VI.; and John and the dukes of Lorraine established manufactories in their domains, and a common kind was made in Dauphiny and Provence. Cast plate is also said to have been established at Cherbourg by artists from Venice, and in 1688 the art was declared noble. Potash, lime, silica, and no lead was employed. Thevart introduced glass casting and plate-glass works at Paris. In France, oxide of lead flint-glass was made at St. Cloud in 1784; another manufactory was subsequently established at St. Louis in 1790; and the St. Cloud establishment was removed to the vicinity of the Mont Cenis, where it flourished till 1827. It is uncertain whether glass was made in England before the 16th c., as that mentioned may have been imported from Flanders or Venice. Window-glass is mentioned by Bede in 674, but was not in general use for windows till the 15th century. In 1557 flint-glass was manufactured at the Savoy and Crutched Friars; in 1565, there were glass-works under Cornelius de Launoy; and in 1567, Jean Quarre and other Flemish manufacturers established works at Crutched Friars, which Quarre's descendants extended to Sussex. In 1615, sir R. Maunsell obtained a patent for making glass, in consideration of using pit coal instead of wood, and oxide of lead was then introduced in 1635; and in 1673, Venetian artists, brought over by the duke of Buckingham, manufactured mirrors of plate-glass at Lambeth, and drinking-glasses were made at this period. But Venetian glass was extensively imported. In 1771, the company of British plate-glass manufacturers was established at Ravenhead, near Prescot, Lancashire; and in 1728, plate-glass was made by the Cooksons at South Shields, and the Thames Plate-glass company in 1835–36. Patent plate was first made in 1840. In Scotland, the manufacture was introduced in the reign of James VI., and George Hay obtained a patent for 31 years. The first glass was manufactured at Wemyss, in Fifeshire, afterwards at Prestonpans and Leith. In 1661, only the principal chambers of the king's palace had glass. In America, attempts seem to have been made to establish glass-works in 1746 at Jamestown, Va.; subsequently, in 1780, at Temple, N. H.; in 1789, at New Haven; and in 1809, at Boston. Plate-glass was first made there in 1853. It is made at Boston, Baltimore, and New York.

At an early period the application of glass for magnifying lenses appears to have been known. Ptolemy II. had a telescope mounted at the Pharos, and globes filled with water were in use for the purpose of magnifying under the Romans. Lenses are mentioned in the 12th c. A.D. by Alhazan, and by Roger Bacon in the 13th c.; towards the close of which, Salvino d'Armato invented eye-glasses, which were subsequently improved by Alessandro Spina. Within the present year (1862), glass-reflectors for telescopes, of great size and accuracy, have been made in France. See TELESCOPE.

As regards processes of making, that called the cylindrical was used by the ancients, and is mentioned by Theophilus at the end of the 12th century.. The rotatory process was first introduced in Bohemia, subsequently into France in 1730, but not into England till 1832. Pressed glass was invented in America. In England, the tendency has been to throw the trade into fewer hands, there having been 24 window-glass factories in 1847, and only 8 in 1858; but the value of the export increased from £26,694 in 1848 to about £500,000 in 1855. The value of the exports of the chief kinds of glass in 1876 was £917,043.—Franks, *Vitreous Art in the Art Treasures of the United Kingdom* (Manchester) *Exhibition* (1858); Pellat, *Curiosities of Glass-making* (1849); *Exhibition of Works of Industry of all Nations* (1851); *Reports of Juries* (1852).

Manufacture.—The manufacture of glass, as at present carried on, may be classed under the following heads: Bottle-glass, crown window-glass, sheet window-glass, plate-glass, flint-glass, colored-glass. The first is the coarsest kind in common use. In this country, it is made generally of soap-makers' waste (which contains a quantity of soda-salts), fresh-water, river-sand, brick-dust, calcined-lime, and marl; to these a quantity of *cullet*, or the broken glass of the works, is always added at a certain stage of the manufacture. This is the mixture employed in making what are called *black bottles*, used for wine, beer, etc. Of late years, light-green colored glass has been preferred for many purposes, such as medicine bottles, soda-water bottles, etc. This color is commonly produced by adding a large proportion of the cullet of crown-glass, which, by its light color, dilutes the darker material; if, however, it is wanted of a finer quality, it is made of sand of a light color, containing only about two-tenths per cent of the

oxide of iron. To 50 parts of this sand are added 20 parts of heavy spar (*sulphate of baryta*), 30 parts of soap-makers' waste, and about two-tenths per cent of oxide of manganese.

In France, kelp and wood-ashes are used to furnish the alkaline portion of the mixture; in other respects, the material is essentially the same. In Germany, where a rich brown tint is in fashion for bottles for the light-colored Rhine wines, the materials consist of a light-colored clay, 16 parts; a light yellow-colored sand, 20 parts; kelp, 8 parts; wood-ashes, 38 parts; cullet, 15 parts; and oxide of manganese, 3 parts.

One of the first essentials to a successful manufacture of glass, is the preparation of the melting-pots. These pots are composed of clay, which is required to be as free as possible from lime and iron. A clay obtained from the carboniferous shales of Worcestershire, in the neighborhood of Stourbridge, is the most esteemed for this purpose; it consists of pretty nearly equal proportions of silica and alumina. The clay is carefully dried and sifted, after which it is mixed with hot water, and worked into a paste; it is then transferred to the kneading-floor, and when sufficiently kneaded—which is done by men treading it with naked feet—it is laid in large masses in a damp stone-cellar to *ripen*, a process, the theory of which is not well understood. When required for forming the pots, a sufficient quantity is taken and again kneaded with one-fourth of its quantity of the material of old pots, which are ground to fine powder and carefully sifted; this material gives firmness and consistency to the paste, and renders it less liable to be affected by heat. The pots are of two kinds, the open and the covered. The first is used for melting common glass, such as hollow and bottle-glass; the other for flint-glass. In each case, the pots are made by hand; and require great skill and care. The bottom is first molded on a board. When the bottom is finished, the workman begins to build up the side of the pot by first forming a ring of the same height all round, taking care to round off the upper edge to a semicircular curve of great regularity; upon this he begins bending over other lumps of the paste until another equal layer is formed, and these are continued until the pot is complete; but the workmen do not work continuously at each pot until it is finished, they leave off from time to time, spreading wet cloths over the edge when they discontinue working. This is necessary to admit of a certain amount of drying; otherwise the large weight of clay used would prevent the form from being kept, and the pot would fall to pieces, or lose shape seriously, the building of the pot is consequently extended over several days. The open conical pots are made from 3 to 4 in. thick, but the flint-glass pots are only from two to three inches. After the potter has finished his work, the pots are removed into the first drying-floor, where they are only protected from draughts, so that the drying may be conducted with the greatest possible uniformity. When they have progressed sufficiently, they are removed to the second drying-floor, which is heated with a stove, and the drying is here completed. They are then placed in the store, where usually a good stock is kept on hand, as time improves them, and they are seldom kept less than six or nine months. When required for use, they are placed for four or five days in the annealing furnace, which is on the reverberatory principle, and they are there kept at a red heat. This furnace is so situated, that the pots, when ready, can be most quickly transferred to the main furnace—an operation of exceeding difficulty, and requiring great skill and dexterity, as they have to be removed whilst red-hot, and it must be done so quickly that no sudden cooling shall injure the pot; a difficulty which can only be understood by remembering that the ordinary pots are nearly 4 ft. in depth, are the same in width at the mouth, by about 30 in. at the bottom, and they weigh several hundred-weights. The enormous amount of labor bestowed upon these pots makes them very expensive, their value being from £6 to £10 each. Their removal from the annealing oven to the main furnace is effected by an immense pair of forceps several feet in length, which are placed horizontally upon an upright iron pillar about 3 ft. in height, which rises from a small iron truck on four wheels, so that the whole apparatus can be easily moved from place to place. By means of this instrument the pot is lifted and dexterously withdrawn from the oven, and as quickly transferred to its position in the main furnace, in which usually four or six are placed on a platform of firebrick or stone, each pot being opposite to a small arched opening, through which it can be filled and emptied. The entrance to the main furnace, through which the pots have been introduced, is then closed with a movable door of firebrick, and covered over with fire-clay, to prevent the escape of heat; the pots in the furnace are filled with the prepared materials for glass, now called *frit*, mixed with about a sixth or eighth part of cullet or broken glass: the openings are closed temporarily for two or three hours, by which time the first charge of material has melted down, leaving room for a further supply, which is then thrown into the pot, and this is repeated two or three times until the pot is completely full. The openings are then closed, and the heat increased to the utmost for ten or twelve hours; this part of the operation is called *founding*, and the result of it is to perfectly melt and vitrify the materials. The heat of the furnace is now somewhat reduced, and the scum is removed from the surface of the melted material, now technically called *metal* by a workman called the *skimmer*, whose labor requires great care and much experience, as the metal is at a glowing white heat, and is only with difficulty distinguishable in the fierce white glare of the furnace. The metal is now ready for the

commencement of the *journey*, as the operation of working it up is called. This term like most others in the glass trade, is derived from the French.

The arrangements so far apply equally to all kinds of glass. We now, however, return to the manufacture of glass bottles, in order the more fully to understand which, we give the following ground-plan of one of the *houses* in which this is carried on (fig. 1): *a* is the main furnace, which in this case is square, and made to hold only four pots; at each corner is an opening, which allows the fire to enter four small reverberatory furnaces, *b*, *b*, *b*, *b*, called *arches;* two are called the *coarse arches*, and the others the *fine arches*. In the two former, the soapmakers' waste is calcined at a red heat for at least four hours, or whilst a set of pots is being worked out—that is to say, one journey. Then the calcined material is ground and sifted in the grinding and sifting house, *h*, after which it is mingled with the sand, etc., and transferred to the fine arches, where for the term of another journey it is again calcined. At the end of that time, the pots being empty, are refilled with this material.

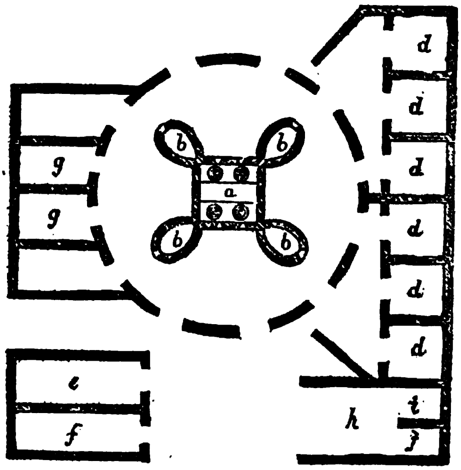


Fig. 1.

When the furnaces are opened for a journey, the skimmer first removes the scum, and makes the way clear for the *blower* and *molder*, who takes his blow-pipe of iron, six feet in length, the part held in the hand being guarded by a covering of wood and other non-conducting materials. After heating the end of the blow-pipe in the furnace mouth, he dips it into the pot, and turning it round, gathers as much metal on the end as is sufficient to form a bottle of the size required. Usually, in bottle making, one gathering suffices, but in larger operations, such as blowing window-glass, more gatherings have to be made. The operator then blows gently down the pipe, and having thus slightly distended the bulb of red hot plastic glass (fig. 2, *a*), he takes it to a plate of polished iron, forming a low bench called the *maver*, or *mavering table*. On this he turns it round, molding the round lump of glass into a conical form, the change being represented in fig. 2, *b*. This operation, called *mavering*, is performed in all cases where glass is blown; and as it is necessary that the glass should be pretty firm before mavering, it is often cooled by sprinkling with water, and even, as in the case of window-glass and other large blowings, turning it in a cavity containing water, which is made by hollowing out a block of wood, usually, if attainable, that of the pear-tree, which is said to be best for the purpose.

After being mavered, the g'ass is held to the mouth of the furnace, and the operator blows down his blow-pipe, and further distends his glass. Formerly, he commenced molding it into the form of a bottle with his shears, one arm of which was of charred wood, and the concave bottom was made by pushing a little piece of glass, called a *punty*, at the end of an iron rod called the *pointel;* the blow-pipe was then detached by a slight blow of the shears, and the partly formed bottle was left at the end of the pointel attached by the punty in the hands of a boy who attends upon the man, and brought and applied the punty. The man then took the pointel in one hand, and after softening the bottle in the mouth of the furnace, molded the neck by means of his shears, regulating the size of the opening by means of a small brass mold, the size and shape of a cork, attached to the middle of the shears; heating the neck again, he formed with a small portion of metal from the pot the ring round the mouth of the bottle. Now, however, after mavering, and the first slight blowing, the operator inserts the glass into an iron or brass mold, which is formed in two pieces, opening or closing by the pressure of the foot on a lever. When the mold is closed, he blows down the pipe, and the bottle is completed all but the neck, the ring of which has to be formed by the addition of a fresh piece of metal, as before described. By this process, bottles are made with wonderful rapidity and exactness. At this stage of the manufacture, by either process, the bottles are taken from the workman by a little boy, who inserts the prongs of a fork into the necks, and carries them to one of the annealing arches, *d*, *d*, *d*, *d*, *d*, *d*, where they are carefully arranged in proper bins until the arch, which usually holds 144 dozen, is full; it is then closed, and the heat is raised nearly to softening point, and then allowed gradually to subside until it becomes cold, when the bottles are removed to make room for a fresh charge. In the plan, fig. 1, *e* and *f* are the sand and alkali stores; *g*, *g*, are stores for the prepared frit; and *i*, *j*, are sifting-cribs in the sifting-house.

Window-glass, whether *crown* or *sheet*, is made of much more carefully selected mate-

rials. They are slightly varied by different manufacturers, but the following are the ingredients used in one of the largest glass-houses in Great Britain: sand (well dried), from the neighborhood of Leighton Buzzard, in Bedfordshire; sulphate of soda, ground; subcarbonate of soda, white oxide of arsenic, manganese, Welsh anthracite, chalk; limestone from Hopton wood, Derbyshire; nitrate of soda; cullet, about as much as is equal to an eighth part of the other ingredients. The exact proportions are only known to the manufacturers. Each ingredient is carefully powdered before mixing, and they are afterwards calcined or fritted, except the anthracite, which is added in the pot for the purpose of decomposing the sulphate of soda, and dissipating its acid; and the manganese and arsenic, which are only added in very small quantities, to improve the color; too much, however, of each is sure to injure the glass, and therefore these materials can only be safely used by experienced manipulators. The bulk of the glass, however, consists of the sand, and carbonate and sulphate of soda.

The arrangement of the window-glass houses is different, and on a much larger scale than in the houses for bottle-glass, and, excepting in gathering and mavering, all the operations subsequent to the founding are different.

When the founding or melting and the skimming are completed, the workman takes his blow-pipe, which is about 7 ft. in length, heats it at the end, and dipping it into the pot of melted glass or *metal* through an opening, he *gathers*, by a slight turn or two, a quantity of glass, about a pound and a half in weight; this he withdraws, and after turning it about for a minute or two in the air until sufficiently cooled, he then dips it in again, and over the first he makes a second gathering, which increases the weight to about three pounds weight; the same cooling process is repeated, and a third gathering is made, which brings up the weight to about nine pounds; he then holds his blow-pipe perpendicularly with the glass downward, so that it may by its own weight pull downward from the pipe in the form of a symmetrical pear-shaped bulb; he next takes it to the hollowed block before mentioned, and turns it round in the water placed in the cavity, by which it is made ready for the mavering table. The workman, by skillful management, *mavers* the bulb of glass into the form *b*, fig. 2, and then forms a little knob at its apex, by turning it on a fixed bar of iron called the *bullion bar;* he then commences blowing, and soon the bulb of nearly solid glass is expanded into a large hollow sphere (*c*, fig. 2), still, however, with the little nipple made by the bullion bar. A little boy now comes forward with an iron rod, the *pointel*, upon the end of which has been gathered a small lump of metal, called the *punty*, about the size of a hen's egg; this he applies to the nipple, to which it firmly adheres, the workman meanwhile resting his blow-pipe on a fixed rest called the *casher-box*, placed for the purpose; by the pressure of the pointel the globe of glass is flattened as in *d*, fig. 2. The application of a piece of iron, cooled for the purpose by keeping it in water, to the junction of the glass with the blow-pipe, detaches it instantly, and the globe of glass is now held with the pointel. The operator carries it next to the nose-hole, and presents the opening formed by the detachment of the blow-pipe to the action of the furnace; this again softens the glass, which is kept continually revolving by turning the pointel on an iron rest or hook fixed to the masonry of the furnace. The revolutions are at first slow, but are gradually accelerated as the softening of the glass goes on, and the centrifugal force so produced throws the edges of the orifice outwards, as in *e*, fig. 2. As the glass flattens, it is revolved with greater rapidity, and advanced so near to the mouth of the nose-hole as to draw the flames outward, by contracting the draught. This completes the softening of the glass, which is done suddenly, with a rushing noise like the unfurling of a flag in the wind, caused by the rapid flying outward of the softened glass and the rush of the flames outwards. It becomes perfectly flat, and of equal thickness, except at the bullion or center, formed, as before described, by the bullion-bar and the punty. The *flashing* is now complete; and the workman removes it from the nose-hole, and still continuing to turn it in his hands, in order to cool and harden it, as he walks along, carries it to the annealing oven, where another one receives it on a large flattened fork-like implement at the moment the *flasher*, who has hold of the pointel, suddenly detaches it by a touch of his shears. It is then passed through the long horizontal slit which forms the opening into the annealing oven, and when fairly in, it is dexterously turned on its edge; here it remains at a temperature somewhat below that required to soften glass, until the oven is filled with these so-called *tables* of glass, when the heat is suffered to decline, until the whole is cold, when they are removed to the packing-room, to be packed in crates for sale.

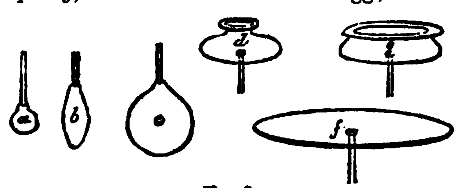


FIG. 2.

Until lately, crown-glass was almost universally employed for windows, but now that which is called *German sheet* has almost displaced it, besides which *British sheet*, which is the same glass polished, and *plate-glass* are much used. The operation of making the sheet-glass is very different from that employed in making crown-glass, inasmuch as a long and perfect cylinder is sought to be produced by the *blower* instead of a

sphere of glass. This necessitates also a different arrangement of the glass-house, as is seen by the ground-plan shown in fig. 8: *aa* is the furnace, *b* is the annealing oven, heated by the flue *b'*, which opens into the main furnace; the *leer*, or annealing oven, is often, however, an independent structure; *c, c, c, c, c, c, c, c*, are the eight pots, which is the number usually employed in these works. These, of course, are opposite to the openings for working them, and in front of each opening is a long opening in the ground, about 8 ft. deep and 8 ft. in width; *d, d, d, d, d, d, d, d*. The workman stands on the edge of this pit, and having made his gathering, as in the crown-glass manufacture (*a* fig. 4), he next *mavers* it, without, however, using the bullion-rod (*b*, fig. 4). He next proceeds to blow his glass, holding it downward whilst doing so, that its weight may widen and elongate the bulb, and from time to time dexterously swings it round, which greatly increases its length (*c*, *d*, fig. 4). As it cools rapidly in this operation, he from time to time places his pipe in the rest which if fixed before the furnace-mouth, and gently turning it round, he brings it again nearly to the melting-point, then he repeats the blowing and swinging, standing over the pit, to enable him to swing it completely round as it lengthens out. These operations are continued until the cylinder has reached its maximum size, that is, until it is of equal thickness throughout, and sufficiently long and broad to admit of sheets of the required size being made from (*e*, fig. 4). Sometimes these cylinders are made 60 in. in length, allowing sheets of glass 49 in. in length to be made from them, but the Belgians make them much larger. In the Vienna exhibition, they exhibited sheets 10 × 4 feet. The next operation is to place the pipe in the rest, and apply the thumb so as to close the opening at the blowing end, the heat of the furnace soon softens the glass at the closed extremity of the cylinder, and as the inclosed air is prevented escaping as it rarefies, by the thumb placed on the opening of the blow-pipe, it bursts at the softened part (fig. 4, *f*); the operator then quickly turns the cylinder, still with its end to the fire, and the softened edges of the opening, which at first are curved inwards, are *flashed* out until they are in a straight line with the sides of the cylinder (*g*, fig. 4). It is then removed, and placed on a rest or casher-box, when a small punty of melted glass at the end of a pointel is is brought by a boy; this the workman applies to one side of the cylinder, just below the shoulder formed at the blow-pipe end (fig. 4, *g*), and drawing it out to a thin string, wraps it quickly so as to draw a line round the cylinder; after a second or two; he withdraws this line of red-hot glass, and touching it quickly with his cold shears, the shoulder and neck drop off as neatly as if cut with a diamond.

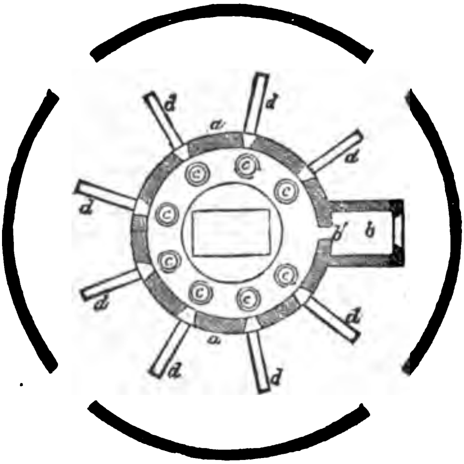


Fig. 8.

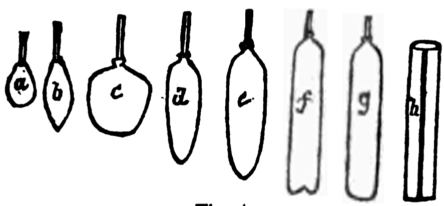


Fig. 4.

The cylinder (fig. 4, *h*) is now placed for a short time in the annealing oven (*b*, fig. 8), where it is prepared for cutting; it is next placed in a groove lined with green baize, and a diamond fixed to a sliding rule makes a perfectly straight cut from end to end. The split cylinder is then taken to the *flattening* arch or furnace, where it is laid on the bottom, with the diamond-cut upwards. The bottom is a perfectly smooth stone, kept constantly free from dust by the workman; here the heat is sufficient to soften without melting the glass, and the *flattener*, as it softens, opens the two edges of the crack until they fall outward flat on the stone; he then takes an implement in the form of a rake, made by placing a piece of charred wood transversely at the end of a long handle, and this is gently rubbed over the glass, producing a very smooth surface. At the back of the flattening arch is an annealing oven, communicating with the arch by a narrow horizontal slit, through which the sheet of glass is now pushed on to a plate of iron, which receives it; and as this plate is one of a series linked together so as to form an endless band, which can be turned round, the sheets move forward into the annealing oven, where the workman gently lifts them on edge until the oven is filled, when, as in the case of crown-glass, the heat is allowed to decline until perfectly cool, the sheets are then ready for use. Very much larger sheets are obtained by this process than by

the former one, hence it is becoming of great importance; but it is not easy to obtain workmen sufficiently powerful and dexterous to blow and twirl the largest-sized cylinders; at present, we obtain almost all the operatives so employed from Belgium.

Glass-shades are made in the same manner as above described; indeed, they are nothing more than the rounded ends of the cylinders before being burst. When wanted oval or square, these forms are produced by boxes of wood charred inside, of the size the shades are required, through which the cylinder is passed when being blown, until the soft glass touches, and receives shapes from the inside of the box or mold: they are afterwards annealed, and cut to the lengths required. If of large diameter, they require immense strength and great skill in the operator, who sometimes aids the power of his breath by taking into his mouth a little spirit, which he blows down the pipe; this is instantly coverted into vapor when it reaches the red-hot cylinder, and aids in distending the glass. Mechanical blowers have been tried successfully in Belgium.

Plate-glass is made in a totally different manner; and, as its value depends chiefly on its purity, the greatest possible care is taken to procure materials of the best quality, and almost every manufacturer has his own private formula for the mixture. It may, however, be said to consist chiefly of sand and alkaline salts, as in other kinds of glass, and the following is one receipt known to be in use: Fine white sand well washed, to free it from impurities, 720 lbs.; sulphate of soda, 450 lbs.; slacked lime, 80 lbs. nitrate of potash, 25 lbs.; and cullet of plate-glass, 425 lbs. These ingredients, when melted and skimmed, should yield about 1200 lbs. of perfectly clear metal, which is the quantity usually required for a casting. When melted and ready for use, the pot is lifted out of the furnace by means of the forceps, and wheeled up to the casting-table; here it is seized by a crane and tackle, by which it is lifted, and so nicely poised over the table, that it can be easily tilted so as to pour out its contents. All this requires so much care and steadiness, that the men impressed with the great danger of carelessness, usually preserve perfect silence during their work. The table is of large size—20 ft. or more in length, by 8 or 10 ft. in width. When the red-hot liquid glass is poured on, it immediately begins to spread; two bars of iron, a little thicker than the plate is intended to be, are quickly laid on each side of the table, and a steel roller is laid across, resting on these bars; this roller is worked by hand, and rapidly spreads the glass all over the table, the bars preventing it from running over the sides, and regulating its thickness. In a very short time it begins to cool; the men then seize the end of it with pincers, and pull it forward with great dexerity on to an endless band of wire-gauze, which, being made to revolve, moves the immense plate forward to a slit-like opening to the annealing oven, where it is worked on to another table on wheels, which is pushed forward to make room for another. The annealing oven is usually of immense length, as, in the case of plate-glass, the sheets cannot be set on edge. At the works at St. Helen's in Lancashire, where glass of all kinds is extensively made, there are usually two annealing ovens to each shed, the furnaces being placed between them; each oven runs to the end of the shed, and these sheds are usually over 300 ft. in length. The main building is a shed, with the doors at each end, and both doors and windows are made so as to exclude drafts of air, which, if admitted during the operation of casting, are highly injurious to the quality of the manufacture.

The plates are next removed to the first polishing shed, where each is imbedded in a matrix of stucco, leaving one surface exposed; the whole is inclosed in a frame, which holds both glass and stucco securely. Two of these frames are placed one over the other, with the two exposed surfaces of glass in contact. The lower frame is fixed, and the upper is made to move by machinery with great rapidity backward and forward with a swinging motion, so as to describe an opposite curve with each backward and forward motion. Sand and water are continually thrown on the surface of the fixed plate, and thus the first stage of polishing is performed. The plates are then readjusted in the frames, and the other surfaces are brought upwards, and receive a similar rubbing down with sand and water. The plates are next removed to the second polishing-room, where women are usually employed; here they are again fixed on low tables, and each woman rubs the surface for a long time with a piece of plate-glass, covering from time to time the whole face of the plate with emery powder and water. After both sides have received this hand-polishing, the plates are removed to a third room, where they are again imbedded on tables which are movable by machinery, so that the whole surface of the plate may be brought under the action of the polishers. These are large movable blocks, covered with woolen cloth and leather, and loaded so as to press on the glass; the polishing material used is colcothar, the red oxide of iron; this completes the polish which gives so much beauty to plate-glass. It is a long and laborious process, and is the chief cause of the high price of plate as compared with other sheet-glass. British plate is only the cylinder glass polished by the processes just described; its comparative cheapness is due to the rapidity with which the cylinder can be blown. Of this rapidity, the best estimate may be formed from a single well-authenticated statement concerning the first crystal palace, which had 18 acres of roof; when the sides are added to this, and a fair addition for the increase caused by the ridge-and-furrow system of the roof, the whole extent may be stated at 25 acres; and yet this vast surface of glass was supplied by Messrs. Chance & Co. of Birmingham, with only an interruption of three weeks to their ordinary business.

Flint-glass and Optical Glass.—The general principle of the manufacture of these two varieties of glass is identical with those already described, the chief difference consisting in the great care taken to insure perfect purity in the materials. The pots used are so made, that the metal is protected from the chance of being contaminated by any accidental impurities falling in or from the gases of the furnace; they are made with a dome-shaped roof and a lateral arch-shaped opening, which is placed opposite the furnace-mouth, so that the workman has easy access to the contents of the pot, which is necessarily smaller, otherwise the workman couldnot dip to the bottom.

The materials used for the best *flint-glass* are varied in other proportions, according to the judgment of the manufacturer; they consist of the whitest sand which can be procured, fine American pearl-ashes (impure carbonate of potash, which is purified by dissolving out the carbonate from its impurities, and evaporating it to dryness in leaden evaporating pans), red lead, or else litharge (the semi-vitrified protoxide of lead), and a small quantity of niter (nitrate of potash). To these, according to their greater or less purity, the manipulator adds more or less of oxide of manganese and arsenic, as correctives; the former removes the green discoloration which the presence of even a small quantity of iron in the sand will produce; and the latter corrects the tendency the manganese has to give a purple tint to the glass. Both substances require the utmost care and judgment in their use, otherwise they are more injurious than beneficial. The following are the usual proportions: sand, 51; pearl-ashes, prepared, 16; litharge, 28 (or red lead, 29); niter, 4½; white arsenic, ⅛; peroxide of manganese, ⅛; cullet of flint-glass in any proportion the manufacturer thinks proper.

Formerly, the silica was obtained by calcining flints, hence the name applied to this kind of glass, but now sand is used instead; and although beautifully white sands are obtained from Lynn, in Norfolk, from the isle of Wight and other parts of Hampshire, from Aylesbury, from France, and even from North America and Australia, it nevertheless requires most careful preparation by washing, calcining, and sifting.

But however carefully flint-glass is made, and however pure and transparent the crystal may be which is so made, it nevertheless possesses some defects, which interfere with its fitness for telescopes, microscopes, lighthouses, and other optical purposes. These defects consist in almost imperceptible striæ in the material, which produce certain optical aberrations. These striæ are known to be caused by the imperfect mixture of the materials, and the want, consequently, of a uniform density. This has been obviated by M. Guinaud and his associate, M. Frauenhofer, by stirring the metal in the pot with an iron rod; but greater improvements have been effected by our own chemist Faraday, who not only improved upon the manipulation of Messrs. Guinaud and Frauenhofer, but suggested also an improvement in the materials, by the addition of carbonate of baryta, and a little carbonate of lime, which produces a glass of greater density and clearness than has ever been known before. Instead of the iron rod for stirring, which of itself is apt to discolor the glass, an iron rod coated with platina is used. In the manufacture of this particular kind of glass, the Messrs. Chance of Birmingham are unrivaled, and they have produced very perfect disks for lenses, weighing as much as two-hundred weights each.

Flint-glass is employed in the manufacture of all the articles of utility and ornament for table and other domestic uses; and as the manufacture of each article requires different management, it would be impossible here to give any satisfactory explanation of the manipulative processes. Suffice it to say, that at present Great Britain is unrivaled in the production of the so-called crystal or flint-glass, which we manufacture of the greatest purity and brilliancy; but in the colored kinds the Venetians take the lead, and excel both in the design and in the art of coloring.

Much flint-glass is now *molded* into drinking-vessels, bottles, and other common articles; but these are always greatly inferior to those which are made by the handicraft of the regular glass-blower.

Colored glass is a general term which includes several distinct varieties: first may be mentioned the glass made for windows and other similar purposes. Colored sheet-glass is made both by the crown-glass and cylinder-glass processes. Sometimes it is of *pot-metal*—that is, the glass and the coloring materials are all melted and worked from one pot—generally, however, this glass is of too dark a color, and the kind called *flashed glass* is most generally used; in this, two pots are employed, one containing the colored glass, as if for pot-metal, the other colorless glass. The workman makes his first gatherings from the colorless glass, and the last only from the colored pot; the consequence is that the glass when finished, although it cannot be perceived, has only a thin skin of the colored material on one side, and the color is thus, as it were, diluted. This has other advantages, because, by skillful grinding, the color may be removed, and transparent patterns produced on the colored ground; and the same may be done, and even delicate shading of the color effected, by eating away the colored side more or less by means of *hydrofluoric acid*, which is frequently employed, and most beautiful effects are produced.

The colors usually employed consist of metallic oxides; other substances are, however, occasionally used. *Gold*, in the state called *purple of Cassius*, invented by Dr. Andrew Cassius of Leyden, in 1632, and also in the state of a simple solution, without tin, yields the most beautiful ruby, crimson, rose, and purple colors. *Copper*, as a suboxide, yields a fine ruby red, and the black oxide gives an emerald green. *Cobalt* yields

the rich deep blues. *Iron*, as a protoxide, gives a dull green; combined with alumina, it gives flesh color, or pale rose, and combined with chloride of silver, it yields an orange yellow; as a peroxide, it gives a common red and a brownish red. *Silver*, with alumina, also yields a yellow color of great beauty; and commoner and less beautiful yellow tints are produced by glass of antimony, and even by carbon, either in the form of soot or charcoal. *Uranium* gives the beautiful chrysoprase green and canary yellow, with a slight degree of opalescence; it also gives an emerald green. Arsenic, or arsenious acid, produces an opaque white. Manganese gives a purple or amethystine color as an oxide; and as a peroxide, with a little cobalt, a fine garnet-red color. These are some of the materials generally employed, but there are numerous others, the use of which depends upon the skill of the manufacturer.

The applications of colored glass to ornamental purposes are very numerous; one has already been fully described under the head of GEMS, ARTIFICIAL. In the hands of skillful glass-workers, especially those of Venice, articles of ornament and utility, combining the most exquisite combinations of form and color, are produced. But not the least interesting application of colored glass is the art of producing windows exhibiting beautiful pictorial designs. So beautiful are the designs of some of the windows formed from this material, that they deservedly rank as works of high art. This art originated at the commencement of the 9th c., and received its greatest development in the 15th century. It then began to decline, until, at the commencement of the present century, it was slowly revived, at first with but little success, a conviction having been formed that the true secrets of the art of producing the rich colors seen in ancient windows were lost. Gradually, chemistry and the microscope removed these errors, the former demonstrating the exact constituents of the best kinds of ancient glass, enabled the manufacturer to imitate it exactly. Still, however, with the same ingredients, there was a remarkable want of richness in the modern material; the cause of this was revealed by the microscope, which showed that it was due to minute pores, which are produced by weathering of the outer surface, the alkaline parts of the glass being washed out, as it were, by the rain, etc. This porosity, by breaking up the surface, destroyed the flatness and glare of the glass, and by mixing more thoroughly the rays of light, produced that richness for which the ancient glass is so famous. Various methods were adopted to produce this effect: one which became common was, to stipple the surface with dots of a dark opaque color; now it is still better and more ingeniously done by sprinkling sand thickly over the gathering of glass before receiving the colored coat, so that when blown and flashed, it has the grains of sand thinly scattered through its substance, and these being refractive, very successfully produce a richness nearly equal to that acquired by age.

So far, indeed, from the art being lost, there is no doubt that a better material and better colors are now made; and those who examine the works produced by Hardman, Ballantine, Chance, and other manufacturers of our country, and those of Munich and other continental works, will not easily believe that the ancients were more successful in their designs than the moderns. But besides the pot-metal and flashed glasses before mentioned, there are two other methods of coloring and producing pictorial effects on glass. The first is by staining, that is to say, painting the glass with various materials, usually metallic oxides finely powdered, and mixed with oil of spike or some other volatile medium; the glass is then placed in a furnace, in which it is made red hot, and a deep stain of the color required is produced on the glass. This process enables the artist to produce a complete picture on one piece of glass; whereas, by the older method, the picture had to be made up of a vast number of pieces set in a slender lead-framing. Generally, both methods are employed in pictorial windows, as the staining enables the artist to give the human features. But staining does not produce the same brilliancy of color, and lessens the transparency of the glass, hence it is in less esteem.

Another mode of decorating glass is by using the opaque, or nearly opaque, enamel colors, and after the design is produced with these, to fix them by firing: this is a beautiful art, and is variously employed.

Lately another and very remarkable invention for decorating glass has been patented by M. Joubert of Bayswater, London—viz., the fixing of photographic pictures upon this material. The sensitive salt used to receive the picture is one which will stain glass; therefore, on firing, the picture is deeply burned into the glass, and cannot be effaced; most beautiful effects are thus produced; natural landscapes and pictures may be transferred with most perfect fidelity.

Glass-grinding and Engraving.—Glass can be easily ground with sand and water, so that the ornamental effect of vessels and other objects of flint-glass may be very greatly enhanced. Sand, however, leaves a rough surface, and destroys the transparency; but this is easily restored by other polishing materials, as emery, putty-powder (oxide of tin), tripoli, red oxide of iron, or colcothar, etc. The cutting and polishing are effected with wheels or disks of sandstone, wood, and metal. Very fine engraving is done with pointed metal tools and diamond-dust; and the latest improvement, introduced by Messrs. Pillalt and Word of London, is using minute wheels, which revolve rapidly, and are dressed with emery or diamond-dust.

The polishing of lenses for optical instruments and for light-houses is an art of very great importance, requiring extraordinary skill. Much of the polishing of the larger

lenses is effected by the aid of machinery, and perhaps no combinations of mechanical art are more wonderful than the machines by which the Messrs. Chance of Birmingham polish the prisms and lenses for catoptric and dioptric light-houses.

Glass in a liquid form has lately been extensively made under the name of soluble glass or silicate of soda; it is silica, or sand, dissolved in a solution of caustic soda. This liquid when used as a varnish, is said to protect stone and other materials from the injurious action of the weather, and for this purpose is now employed to arrest the decay of the stone of the new houses of parliament. It has been recommended to be used as a dressing for muslins and other fabrics, to render them fire-proof. Several methods have been devised for tempering, hardening, or toughening glass; but none has yet attained commercial importance.

GLASS (*ante*), in some of its coarser forms, was manufactured in this country in the colonial period. John Smith's *History of Virginia* alludes to the subject, and expresses the opinion that in this as in other things the "labor of the colony," as early as 1615, "had been misdirected." Seven years later, a building begun in Jamestown, Va., for this manufacture, was abandoned on account of troubles from the Indians. Somewhere about 1754, a Dutchman named Bamper established a glass factory in Brooklyn, N. Y., and the first bottle he made is preserved among the curiosities of the Long Island historical society. Another factory of the same kind was established in Temple, N. H., in 1779 or 1780, but was shortly burned down and never rebuilt. Another was established by a company of which Albert Gallatin was one, on the Monongahela river, above Pittsburgh in 1789, and tradition asserts that there was one also in New Haven, Conn., in 1789, or before. The first glass factory in Pittsburgh, was built in 1795, and in it the production of window-glass was first begun in this country. Other factories were soon afterwards built in the same place, also in Rensselaer and King counties, N. Y., and in New Jersey and Massachusetts. From this time onward, the manufacture kept pace with the growth of the country, until, in 1830, the number of furnaces for the manufacture of crown-glass was 21, of flint-glass 23. The value of the flint-glass annually produced was estimated at $1,350,000. In 1840, the number of establishments had increased to 81, giving employment to more than 3,000 people, and a capital of more than $2,000,000. The increase in the next 20 years was very considerable, the number of glass works in 1860 being 112, employing over 9,000 men and more than $6,000,000 of capital. In 1870 the number of glass factories of every kind was 201; the number of people employed 15,822 (11,505 men, 715 women, and 3,602 children): capital invested, $14,111,642; wages paid $7,846,425; raw material used, $6,133,168; annual product, $19,235,862. Of the whole number of factories 35 were devoted to the production of window-glass, 11 of them in New Jersey, 10 in Pennsylvania, 7 in New York, and the others in Massachusetts, Maryland, and Illinois. The establishments devoted to the manufacture of glass-ware of all kinds was 114, producing goods valued at $14,300,949. Forty-two of these factories were in Pennsylvania, 32 in New York, 11 in Massachusetts, 8 in New Jersey, 6 in Ohio, and the others in Connecticut, Indiana, Kentucky, Missouri, New Hampshire, and West Virginia. Eighteen establishments were producing stained glass to the value of $297,480; 29 were employed in the production of cut-glass, the goods annually being valued at $470,875. Five plate-glass establishments reported an annual product of $355,250. The census of 1870, however, is believed to be deficient in its statistics of glass production, falling far below the actual truth. Since that time the business has developed rapidly. The value of the glass produced in this country in 1880 can hardly be less than $30,000,000, and may be much more. We are exporting glass hollow-ware largely. American table glass is not inferior to that of England and France. American window-glass (not plate) finds a ready market abroad as well as at home. American plate-glass is inferior to that of Europe, but is not likely to remain so long. The importations hither of foreign glass are rapidly diminishing. The total importation in 1872–73 was $7,420,044; in 1873–74, $6,257,978—a reduction of more than $1,000,000 in a single year.

GLASSCHORD, a musical instrument, with keys like a pianoforte, but with bars of glass instead of strings of wire. It was invented in Paris in 1785 by a German called Beyer. The name glasschord was given to the instrument by Franklin. When the glasschord was completed, it was exhibited publicly in Paris, and performed on by the inventor; but it never was received with favor by the instrument-makers, so that no more were ever made, as possibly its construction and mechanism remained a secret with its inventor.

GLASS-CRABS (*Phyllosomata*), a family of crustaceans, of the division *malacostraca*, order *stomapoda* of Cuvier, remarkable for the transparency of their bodies, whence their popular name, whilst the scientific name (Gr. leaf-body) refers to the great horizontal expansion of the carapace. They have little resemblance to crabs. The head is represented by a large oval plate, bearing eyes mounted on very long stalks: a second plate, the breadth of which much exceeds its length, represents the thorax, and bears the feet, most of which are long, and some of them, as in a few other crustaceans, bifid, with one branch much longer than the other. The abdomen is small. Milne-Edwards supposes these creatures to have no special organs of respiration, but that the blood is aërated through the general surface of the body. They are found in tropical

and sub-tropical seas; and so transparent are they, that, when floating on the surface of the water, they would not be perceived but for the beautiful blue of their eyes.

GLAS'SITES, a religious sect, which sprung up in Scotland about 1730, when its founder, John Glas, a native of Auchtermuchty, in Fife, and minister of the parish of Tealing, near Dundee, was deposed by the general assembly of the church of Scotland, chiefly on account of views which he had adopted and published concerning the nature of the kingdom of Christ. In his *Testimony of the King of Martyrs concerning his Kingdom*, founded on the words of our Savior, recorded in John xviii. 36, 37, Mr. Glas maintained that all national establishments of religion are inconsistent with the true nature of the church of Christ, and was thus probably the first assertor of the *voluntary* principle in Scotland. He also advocated a system of church-government essentially *independent* or *congregational*. After his deposition by the general assembly, he became the pastor of a congregation. He died at Dundee in 1773. His personal worth and piety were acknowledged even by the most strenuous opponents of his peculiar opinions. A number of small congregations or *churches* were soon formed on *Glassite* principles, not only in Scotland, but in England and America; but both in England and America, the name of a follower of Glas, Robert Sandeman, prevailed over his own, and the sect received the name of *Sandemanians*. Sandeman, a native of Perth, is chiefly known from his advocacy of certain views respecting the nature of saving faith, now commonly designated *Sandemanian*, essentially consisting in representing faith as "a bare belief of the bare truth," which belief, however, both Glas and Sandeman, with at least their immediate adherents, regarded as the fruit of divine grace and the work of the Holy Spirit. The Glassites have, since the beginning of the 19th c., decreased in numbers. In 1851 there were only six Glassite churches in Scotland, none of which contained very many members; and at the same date only six Sandemanian churches existed in England. The Glassites maintain the necessity of a plurality of teaching *elders* in every church, but do not require any special education for this office or separation from secular employments; they hold a second marriage a disqualification for it; they deem it unlawful to join in prayer with any one who is not a brother or sister in Christ; they observe the Lord's supper weekly; they maintain *love-feasts* or dinners between morning and afternoon services, at which it is incumbent on every member of the church to be present; they are rigid in abstaining from things strangled and from blood; and in general hold by the most literal interpretation of other Scripture rules, as concerning the kiss of charity, and the washing of the feet of fellow-disciples; they disapprove of games of chance, and of all use of the lot except for sacred purposes. Their charity, both to their own poor and to the poor of other denominations, is said to be exemplary.

GLASS-MEN were wandering rogues or vagrants, under the statutes 39 Elizabeth c. 4, and 1 James I. c. 7.

GLASS-PAINTING (in art). The application of colored glass to the artistic decoration of windows has been previously alluded to, but the very high position which it formerly attained, and which it is again rapidly approaching, renders it necessary to devote a short space to its relationship to the fine arts.

Originally, there was but one method of making ornamental glass windows, and that was to produce the pattern in outline with finely made leaden frames, into the grooves of which pieces of colored glass or of stained glass were fitted. Modern chemistry has, however, so improved the art of glass-staining, that large pictures may now be produced on single sheets of glass, as in the case of the windows shown by the St. Helen's crown glass company, in the exhibition of 1851, one of which, designed by Mr. Frank Howard, representing "St. Michael Casting Out the Great Dragon," was upwards of 9 ft. high by 3 ft. broad. It was on plate-glass, and had to be *fired* or submitted to intense heat 15 times, notwithstanding which it was perfectly smooth, and although somewhat deficient in brilliancy of color, was an excellent and effective composition.

One of the best known of the early applications of glass to window decoration is that in the monastery of Tegernsee, in upper Bavaria, which was secularized in 1803, and is now a private residence; but these windows (executed in the latter half of the 10th c.), like all of the first attempts, were only tasteful arrangements of colored glass in imitation of the stone mosaics used for floors, etc. Nor did the art rise much above this for at least three centuries after its origination; but in the 13th c., owing to the full development of the Gothic style of architecture, it became of immense importance, colored glass taking the place of tapestried curtains in filling up the spaces within the groined arches. The mosaic patterns were superseded by elaborate designs, not only in beautiful arabesque and other styles of decorative art, but even pictorial compositions were attempted; and to such perfection did this arise, that many of the works produced in the 15th c. are marvels of art. In all of these, the figures, with the exception of the faces, were made up of pieces of self-colored glass, combined with great skill and taste; the features were painted in enamel colors, and burned in, and the art of the artist was shown by giving ease and grace to the figures corresponding to the expression of the faces. Gradually the art of shading, by removing certain portions of the colored surface, and other improvements were effected. This was the culminating point in the history of the first period of glass-painting, as it is called, and seemed to have attained the highest perfection of which it is susceptible, for the efforts which followed to improve it

by assimilating it to oil-painting signally failed, and with this failure began that decline in the art which was perhaps more remarkable in the instance of glass-painting than in any other, for in a comparatively short time it began to be felt that the true art was lost. Since the commencement of the present century, rapid strides have been made towards improvement; and the renaissance bids fair to eclipse the glory of the first epoch. The great seats of this art are now in Munich, Nuremberg, Paris, Birmingham, Edinburgh, and one or two more places; and it never received more liberal patronage in its palmiest days than it now does.

GLASS PAPER, or CLOTH, is made by powdering glass more or less finely, and sprinkling it over paper or calico still wet with a coat of thin glue; the powdered glass adheres as it dries. Glass paper is very extensively employed as a means for polishing metal and wood-work; it is sold in sheets, and is very largely manufactured at Birmingham and other places.

GLASS SNAKE (*Ophisaurus*), a genus of reptiles, belonging to the group *Saurophidia* of Gray, ranked by some naturalists among serpents, and by others among saurians. There is only one known species, a common native of the United States. It is serpent-like in form, and entirely destitute of limbs. The head is like that of a lizard. The eye has a movable lid, as in lizards. The length is sometimes three feet and a half. The body and tail are marked with transverse lines of black, green, and yellow, each scale exhibiting these three colors. The mouth is small, and the animal feeds on insects, mollusks, etc. It frequents dry places, and can neither climb nor swim. It is remarkable for the readiness with which the joints of the tail break off upon any irritation, so that it is very difficult to secure a perfect specimen. The joints thrown off are soon reproduced. The caudal muscles do not pass from one joint to another, so that the breaking of the tail involves no rupture of muscular fibres, but only a separation of one muscular plate from another.

GLASS, SOLUBLE. See Water Glass, *ante*.

GLASS SPONGE, or GLASS ROPE, the name of various siliceous sponges which have the sponge spicules prolonged into a flexible loosely twisted cable of glassy threads. Their nature is not well understood.

GLASSWORT (*Salicornia*), a genus of plants of the natural order *Chenopodiaceæ*, having uniform hermaphrodite flowers, with a single fleshy obscurely lobed perianth imbedded in an excavation of the *rachis*, one stamen or two, and a short style, the fruit a *utricle* inclosed in the enlarged perianth. One species (*S. Herbacea*) a leafless plant with jointed stems, is common in salt marshes in Britain. It makes a good pickle; and is sometimes sold for this purpose. Several species grow abundantly on the shores of the Mediterranean; and as they contain a large quantity of soda, are used in making *barilla*, along with the species of Saltwort (q.v.).

GLASTONBURY, an ancient municipal burgh and market-town in the co. of Somerset, 25 m. s.w. of Bath, is built in the form of a cross, and occupies a peninsula formed by the river Brue, or Brent, called the Isle of Avalon. It has small manufactures of silk, and some export trade in timber, slates, tiles, and agricultural produce, by means of a canal connecting it with the Bristol channel, and the railway between the Bristol and Exeter, and Wilts and Somerset lines which passes through Glastonbury. Pop. '71, 3,670. The town owes its origin to its celebrated abbey, which, according to tradition, was founded in 60 A.D., and was one of the earliest seats of Christianity in Britain. Its traditionary founder was Joseph of Arimathea, and the "miraculous thorn," which flowered on Christmas-day, was, till the time of the Puritans, believed by the common people to be the veritable staff with which Joseph aided his steps from the Holy Land. The tree was destroyed during the civil wars, but grafts from it still flourish in the neighboring gardens. In 605 A.D. the monks adopted the dress and rules of the Benedictine order. This magnificent pile at one time covered 60 acres; but as most of the houses in Glastonbury, and also a causeway across Sedgemoor, have been constructed of the materials, the extent of the ruins is now much diminished. The most interesting remains are the Abbey church, with St. Joseph's chapel, St. Mary's chapel, and the Abbot's kitchen. St. Joseph's chapel is one of the most elegant specimens in existence of the transition from Norman to early English architecture, and is supposed to have been erected during the reigns of Henry II. and Richard I. It is now roofless, and the vaulting of the crypt is nearly destroyed. The entrance is adorned with sculpture. Below the floor is a Norman crypt, within which is St. Joseph's well. Of the Abbey church few fragments remain. The chapel of St. Mary is roofless, but the remains of its pointed windows and archways are exceedingly elegant. The Abbot's kitchen, now separate from the rest of the ruins, is a square massive structure, the walls strongly buttressed, and dates from about the 15th century. Glastonbury has the honor of ranking St. Patrick (415 A.D.) and St. Dunstan among its abbots. In 1539 Henry VIII. summoned abbot Whiting to surrender Glastonbury and all its treasures; and on his refusal, condemned him to be hanged and quartered, and the monastery confiscated to the king's use, which sentence was immediately carried into execution. According to tradition, king Arthur and his queen Guinevere were buried in the cemetery of the abbey; and Giraldus Cambrensis states that "a leaden cross, bearing the

following inscription, *Hic jacet sepultus inclytus Rex Arthurus in insula Avallonia*, was found under a stone 7 ft. below the surface; and 9 ft. below this was found an oaken coffin, containing dust and bones." This disinterment took place by order of Henry II. The only other objects of interest at Glastonbury are the church of St. Benedict; the church of St. John the Baptist, with a tower of 140 ft. high; the Weary-all hill, where Joseph of Arimathea rested from his weary pilgrimage; and the Tor hill, where the last abbot of Glastonbury was put to death, 500 ft. above the sea-level, crowned by a tower, the ruin of a chapel of St. Michael.

GLATZ, a t. of Prussia, in the province of Silesia, is a fortress of the second rank, and is situated between two fortified hills, on the left bank of the Neisse, 52 m. s.s.w. of Breslau. It has four Catholic churches and a Catholic gymnasium; and carries on considerable manufactures of linen, damask, and woolen fabrics, as well as of leather and rose-garlands. Pop. '75, 12,553, including 1657 of a garrison. During the thirty years' and the seven years' wars, Glatz was frequently besieged and taken.

GLAUBER, JOHANN RUDOLPH, a German chemist and physician, was b. at Karlstadt, in Franconia in 1604, and died at Amsterdam in 1668. No details regarding his life are known, except that he resided for a long time at Salzburg, then at Kissingen, then at Frankfort-on-the-Main, then at Cologne, from whence he probably removed to Amsterdam. Although a believer in the philosopher's stone and in the universal medicine, he contributed very materially to the progress of chemistry. Poggendorff (in his *Biographisch-literarisches Handwörterbuch*) gives a list of about 30 of his works, of which a collected edition up to the date of publication appeared, in two quarto volumes, in 1658–59, at Frankfort, and another edition, in seven octavo volumes, in 1661 at Amsterdam. An English translation by Packe, in one large folio volume, was published in London in 1689. His name at the present day is chiefly known for his discovery of sulphate of soda, which he termed *sal mirabile*, and regarded as a universal medicine, and a cure for all diseases.—See Kopp's *Geschichte der Chemie*, vol. i. pp. 128–133.

GLAU'BER'S SALT (so called from Glauber, who discovered it in 1658) is the popular name of the neutral sulphate of soda, whose chemical composition is represented by the formula $NaO,SO_3 + 10aq$. It occurs in long four-sided translucent prisms, terminated by dihedral summits, and containing 10 atoms of water. On exposure to the air, the crystals lose all their water, and become resolved into a white powder. When heated, they readily melt in their water of crystallization; and if the heat is sufficiently continued, the whole of the water is expelled, and the anhydrous salt remains. Glauber's salt has a cooling, bitter, and saltish taste; it is readily soluble in water; its solubility (in the ordinary crystalline form) increasing up to 92°, when it appears to undergo a molecular change, and to be converted into the anhydrous salt, which at this temperature is less soluble than the hydrated compound, and separates in minute crystals. This and other anomolies which occur in the solubility of this salt have been carefully studied by Löwel (*Ann. de Chemie*, 3d ser. vol. ix. p. 50).

Glauber's salt is a constituent of many mineral waters, and occurs in small quantity in the blood and other animal fluids. It occurs, under the name of *thénardite*, near Madrid, in the form of anhydrous octahedra deposited at the bottom of some saline lakes; and is found combined with sulphate of lime, as *Glauberite* ($NaO,CaO,2SO_3$), in the valley of the Ebro.

The anhydrous salt is prepared in enormous quantity from common salt and oil of vitriol, with the view of being afterwards converted into carbonate of soda. See SODA.

For medical use a purer form is required. The salt which remains after the distillation of hydrochloric acid—this salt being sulphate of soda contaminated with free sulphuric acid—is dissolved in water, to which is added powdered white marble (carbonate of lime), to neutralize the free acid, and to precipitate it as an insoluble sulphate: the solution is boiled down till a pellicle appears, is strained, and set aside to crystallize.

It is used as a common purgative, and is especially applicable in fevers and inflammatory affections, when it is necessary to evacuate the bowels without increasing or exciting febrile disturbance. The usual dose is from half an ounce to an ounce; but if it is previously dried, so as to expel the water of crystallization, it becomes doubly efficient as a purgative. It is now much less frequently used in domestic medicine than formerly, having given place to milder aperients.

GLAUBER'S SPIRIT OF NITER is one of the old terms for nitric acid (q.v.).

GLAU'CHAU, a thriving manufacturing t. of the kingdom of Saxony, is picturesquely situated on the right bank of the river Mulde, 8 m. n.n.e. of Zwickau. Owing to the unevenness of its site, it is irregularly built; but its appearance is striking. It is the second in rank among the manufacturing towns of Saxony. Here, and in the neighborhood, the weaving of every kind of goods flourishes; there are also important dye-works, print-works, iron-foundries, and machine-factories. Pop. '75, 21,743.

GLAUCO'MA (Gr. *glaukos*, sea-green), an opacity of the vitreous humor of the eye, characterized by a bluish tint seen from without, and the absence of the peculiar characters of cataract (q.v.), which, in some respects, it resembles as regards the gradual obscuration of vision. It is an almost incurable disease.

GLAUCONIE, a French term introduced by M. Brogniart as the name of several strata of different ages. The glauconie crayeuse and sableuse are equivalent to the upper and lower green sand, while the glauconie crossier is an eocene deposit contemporaneous with the Bracklesham beds.

GLAUCONITE, a mineral found in secondary and tertiary green sands and chloritic marls, the composition of which is about: Silica, 46 to 56 per ct.; ferruginous oxide, 20 to 25 per ct.; potash, 5 to 13 per ct.; water nothing to 10 per ct.

GLAU'CUS, a genus of mollusks, referred to the class *gasteropoda*, but having no distinct respiratory organs. The body is long, slender, gelatinous, furnished with three pair of digitated fin-like appendages, which were formerly supposed to be gills. The mouth has horny jaws, adapted for preying on other small marine animals. These small mollusks—about an inch and three-quarters long, of a blue color, and extremely delicate and beautiful—inhabit the tropical parts of the Atlantic ocean, and float inertly with irregular movements of the slender branches of their fins on the surface of the water.

GLAUCUS, an artist of Chios, said to have invented the art of soldering metals. His most famous work was the iron base on which was placed a silver vase dedicated by Alyattes II., king of Lydia, to the god at Delphi, spoken of with admiration by Herodotus.

GLAUCUS, son of Hippolochus, and grandson of Bellerophon, mythical progenitor of the kings of Ionia, was a Lycian prince, who, along with his brother Sarpedon, assisted Priam in the Trojan war. The incident between Glaucus and Diomede, as related in the Iliad, is well known. He was afterwards slain by Ajax; but his body was carried back to Lycia, as that of his brother had been. It seems probable that these two sons of the Lycian land—the land of light—who leave it in youth, but are carried thither again (by Hypnos and Thanatos) when their course is done, originally were here meant to represent respectively the creeping light of the early drawn (Sarpedon) and the brightness of the open day (Glaukos).

GLAUCUS, son of Minos by Pasiphæ, when a child, playing at ball or pursuing a mouse, fell into a honey pot and was smothered. His father, after a vain search for him, consulted the oracle, and was referred for an answer to the person who could suggest the aptest comparison for one of the cows of Minos which had the power of assuming three colors. Polyidus of Argos, who had likened it to a mulberry (or bramble), which changes from white to red, and then to black, soon afterwards discovered the child. Minos then desired him to restore young Glaucus to life; and on his failure to do this, he was sentenced to be entombed alive along with the corpse. Having in the sepulcher killed a serpent by which he had been attacked, he saw its companion revivify it by laying upon it a few leaves of a certain herb. The same herb he applied successfully to Glaucus. This curious myth is now very generally admitted to be of a solar character; but interpreters are far from unanimous as to the significance of the various details.

GLAUCUS, surnamed PONTIUS, a fisherman changed to a god and endowed with the gift of unerring prophecy. A principal seat of his cultus was at Athedon, where the inhabitants claimed to be descended from him; but he was also worshiped extensively, not only on the coasts of Greece, but also on those of Sicily and Spain, it being customary for fishermen and sailors at certain seasons to watch during the night for the moment when he should come on his periodical rounds accompanied by his train, in order that they might consult him as an oracle. He is generally represented as endowed with most of the attributes of Nereus, but occasionally he is identified with Melicertes. He is sometimes said to have instructed Apollo in prophecy. In art he is depicted as a vigorous old man with long hair and beard, his body terminating in a scaly tail.

GLAUCUS, surnamed POTNIEUS, a deity worshiped chiefly in Corinth, is to be distinguished from Glaucus Pontius. He was the son of Sisyphus by Merope, and the father of Bellerophon. According to the legend, he was destroyed by his own mares, the most common form of the story being that he was torn to pieces by them. Accounts differ as to the place of his violent death, and also as to the immediate occasion of it. Sometimes it is represented as having happened at Iolcus, at the funeral games of Pelias, but usually the scene is laid at Potniae. He is most frequently represented as having offended Aphrodite by having kept his mares from breeding; but other versions of the myth are that he had fed them on human flesh to make them more spirited, or that they had been suffered to drink at a sacred well at Boetia, or that they had eaten the herb hippomanes. He was the subject of a lost tragedy of Æschylus. His affinities with Poseidon Hippius are obvious; and it may be taken for granted that the frantic horses of Glaucus Potnieus represent the stormy wave of the sea, just as Glaucus Pontius is himself a personification of the ocean in its friendlier and calmer moods.

GLAUX, a genus of plants of the natural order *primulaceæ*, having a 5-lobed calyx, no corolla, and a 5-valved capsule with about five seeds. Glaux *maritima*, sometimes called SEA MILKWORT and BLACK SALTWORT, is one the most common plants of our sea-coasts, growing in almost every muddy situation. It is a small plant, with branching stems, often procumbent, and small fleshy leaves. It makes a good pickle.

GLAZE. See POTTERY.

GLEAN'ING. In comformity with the positive command contained in the Mosaic law, to leave the gleanings of the harvest to the poor and to the stranger (Lev. xix. 9, and xxiii. 22) there has been almost everywhere a popular feeling to the effect that the farmer was not entitled to prevent the poor from gathering what the reaper had left behind. In England, the custom of gleaning had very nearly passed into a legal right, for there is an extra-judicial dictum of lord Hale, in which he says that those who enter a field for this purpose are not guilty of trespass, and Blackstone (iii. 12) seems disposed to adopt his opinion; but the question has since been twice tried, and decided in the negative in the court of common pleas, the court finding it to be a practice incompatible with the exclusive enjoyment of property, and productive of vagrancy and many mischievous consequences (1 H. Bl. Rep. 51). It is still, however, the custom all over England to allow the poor to glean, at least after the harvest is carried. The privilege is one which, both from motives of humanity and of economy, ought certainly to be continued within proper limits, because it not only adds to the comfort and well-being of the poor, but by preserving from waste a portion of the fruits of the earth, and by employing children and infirm persons whose labor would not be available for any other purpose, it diminishes the expenditure for the support of the indigent, which already presses so heavily on the industrious portion of the community. It is a privilege, however, which is apt to be abused by able-bodied persons, who, by rising early in the morning, and going into fields from which the crop has only been partially carried, contrive to carry off grain to a greater value than the wages which they could have earned by honest harvest-work. With a view to checking this abuse, farmers in various districts have established rules for regulating the practice of gleaning. Some curious statistics on the subject of gleaning were published in the *Journal of the Statistical Society of London*. In Bohn's *Political Dictionary*, under the head "Gleaning," a statement is made showing that the total gleanings of 388 families was £423 12*s*., and the average for each family £1 1*s*. 10*d*., which was one-fifth of the average harvest-wages of each of the same number of families.

In Scotland, it has been more than once decided that the poor possess no right to glean, at common law, and that the farmer may exclude them from his fields (Hutch. *Justice of the Peace*, ii. 47; Dunlop's *Paroch. Law*, 223).

GLEBE (Lat. *gleba*, a clod or lump of earth), the land possessed as part of an ecclesiastical benefice, or from which the revenues of the benefice arise. The assignment of glebe-lands was formerly held to be of such absolute necessity, that without them no church could be regularly consecrated. In England, the word manse includes both the parsonage-house and the glebe, whereas in Scotland it is applied exclusively to the house. The fee-simple of the glebe is held by the law of England to be in *abeyance*, from the French *bayer*, to expect—that is to say, it is only "in the remembrance, expectation, and intendment of the law;" but after induction, the freehold of the glebe is in the parson, and he possesses most of the powers of a proprietor, with the exception of the power of alienation. Previous to the reformation the clergy possessed certain powers of alienation at common law; and if a bishop, with the assent of his chapter, or an abbot, with the assent of his convent, or the like, alienated glebe-lands, the deed would not have been void, because the fee-simple was in the holder of the benefice for the time being; but by 1 Eliz. c. 19, and 13 Eliz. c. 10, all gifts, grants, feoffments, conveyances, or other estates, shall be utterly void and of none effect, notwithstanding any consent or confirmation whatsoever. Neither could the incumbent exchange the lands or any portion of them without the authority of an act of parliament. This restriction was done away by 55 Geo. III. c. 147, for enabling spiritual persons to exchange parsonage or glebe houses or glebe-lands for others of greater value or more conveniently situated for their residence and occupation. By 5 and 6 Vict. c. 54, it is now provided that the commissioners appointed to carry into effect the commutation of tithes, shall have power to ascertain and define the boundaries of the glebe-lands of any benefice, and also power, with consent of the ordinary and patron, to exchange the glebe-lands for other lands within the same or any adjoining parish, or otherwise conveniently situated. The subsequent act 17 and 18 Vict. c. 84 moreover provides that the incumbent of any benefice entitled to glebe, shall, with such consents as are specified in the act, be entitled to annex such glebe or other lands by deed to any church or chapel within the parish, district, or place wherein such glebe or land is situate. In addition to his glebe-lands, the rector or vicar is also seized in the edifice of the church itself (see CHURCH). It was long ago provided (28 Henry VIII. c. 11, s. 6), that if an incumbent died after having manured and sown the glebe-lands, he might make his testament of the profits of the corn; but if his successor be inducted before the severance thereof from the ground, he shall have the tithe; for although the executor represent the person of the testator, yet he cannot represent him as parson.

Glebe, in Scotland.—In Scotland, as in England, a glebe forms, as a general rule, a portion of every ecclesiastical benefice of the established church, and is thus an addition to the stipend, and sometimes a very important one. Ministers in royal burghs, however, cannot claim glebes, unless in the case in which there is a landward district attached to the parish. Even then, if there are two ministers, only the first can claim a

glebe. Where parishes are disjoined, or separated into two portions, moreover, it does not necessarily follow that the portion erected into a new parish shall contain a glebe. By 5 Geo. IV. c. 72, provision is made for payment of compensation out of the public revenue, in lieu of manse and glebe, to ministers whose stipends do not exceed £200. If there are arable lands, the glebe must not be less than four acres. If there is no arable land, the minister is entitled to sixteen *soums* of grass adjacent to the church. A soum is as much as will pasture ten sheep or one cow, so that the actual extent varies with the richness of the soil and consequent quality of the pasture. The presbytery possesses the power of designing glebes, the heritor from whose property the glebe is designed having recourse against the other heritors of the parish. By 1572, c. 48, it is enacted that the glebe shall not be alienated by the incumbent. As the act limits its prohibition to such alienation as may be detrimental to the successor of the incumbent, it has been doubted whether the latter might not feu. The court, however, has been very unwilling to sanction this proceeding; and from the fact that land tends steadily to increase, whereas money diminishes in value, it seems of very doubtful propriety even where the arrangement is very advantageous at the time. When the church is changed, or transported, as it is called, to a new site, the court will authorize the sale or excambion of the glebe, but such excambions must be sanctioned by the presbytery. Where minerals are found on the glebe, they are worked under the superintendence of the heritors and presbytery for the behoof of the incumbent. Trees growing on the glebe are thought to belong to him. See TEIND COURT.

GLEDE, a name in the common English versions of the Bible which probably means vulture.

GLEE, the English name of a vocal composition for three or more voices, and in one or more movements. The style of music of the glee is peculiar to England, and quite different from the part songs of Germany.

GLEET. See GONORRHŒA.

GLEIG, GEORGE, 1753–1839; bishop of Brechin, Scotland, was the son of a farmer, and was born in Kincardinshire. He received his early education at the school of Arbuthnott, and at the age of thirteen, entered King's college, Aberdeen, where he especially distinguished himself in mathematics and the moral sciences. In his 21st year he took orders in the Scottish Episcopal church, and was ordained to the pastoral charge of a congregation at Pittenween, Fife, whence he removed in 1790 to Stirling. His pastoral duties allowing him considerable leisure for literary pursuits, he became a frequent contributor to the *Monthly Review*, the *Gentleman's Magazine*, the *Anti-Jacobin Review*, and the *British Critic*. He also wrote several articles for the third edition of the *Encyclopædia Britannica*, and on the death of the editor, Colin Macfarquhar, in 1793. was engaged to edit the remaining volumes. One of his principal contributions to this work was the article "Metaphysics." He was twice chosen bishop of Dunkel, but the opposition of the primus rendered the election on both occasions ineffectual. In 1808 he was consecrated assistant and successor to the bishop of Brechin, in 1810 was preferred to the sole charge, and in 1816 was elected primus of the Episcopal church of Scotland, in which capacity he greatly aided in the introduction of many useful reforms, in fostering a more catholic and tolerant spirit, and in cementing a firm alliance with the sister church of England.

GLEIG, the REV. GEORGE ROBERT, M.A., a popular author and divine, son of the right rev. George Gleig, LL.D., bishop of Brechin, and primus of the Scots Episcopal church, was born at Stirling, in Scotland, in 1796. In 1812 while a student at the university of Oxford, he joined, as a volunteer, a regiment then marching through that city on its way to Lisbon. Soon obtaining a commission in the 85th regiment of light infantry, he served in the peninsula. During the American war in 1812–14, he was engaged in the campaign of Washington, at the capture of which city, in Aug., 1814, he was severely wounded. In 1821 he published an account of the *Campaigns of Washington and New Orleans*, 8vo. At the close of the war, he retired on half-pay. He now completed his studies at Oxford, entered into holy orders, and in 1822 was presented by the archbishop of Canterbury to the living of Ivy church, Kent. In 1825 he published *The Subaltern*, a novel founded on his experience in the peninsular war. In 1844 he was appointed chaplain of Chelsea hospital, and in 1846 chaplain-general of the forces. Having devised a scheme for the education of soldiers, he was appointed inspector-general of military schools. In 1848 he was made a prebendary of St. Paul's cathedral, London. Gleig has written a great variety of biographical, historical, and religious books. The most interesting and important of all his works is his *Life of the Great Duke of Wellington* (1859). He resigned the office of chaplain-general in 1875.

GLEI'WITZ, a t. of Prussia, in the s.e. of the province of Silesia, is pleasantly situated on the Klodnitz, a small affluent of the Oder, 43 m. s.e. of Oppeln. It contains three churches, a synagogue, and a Catholic gymnasium, and is noted for its royal foundries, iron-works, machine-works, flour-mills, etc. Pop. '75, 14,156.

GLENCOE', a valley well known not only for the terrible massacre through which it has become historically famous, but also for the wildness and sublimity of its scenery, is situated in the n. of Argyleshire, near the border of Inverness, at loch Leven. It is

about 8 m. in length, and is divided into an upper and lower valley by a gentle ridge. It is traversed by a mountain-stream called the Cona, and its scarred sides show the beds of numerous mountain-torrents. Excepting a solitary inn, the traveler looks in vain for any token of social life or of civilization.—MASSACRE OF GLENCOE. The principal circumstances of this famous tragedy are briefly as follows: The state of the Highlands in the year which followed the parliamentary session of 1690 was such as to give the government much anxiety. The civil war which had recently been flaming there continued still to smolder, and at length it was determined, at court, to employ £12,000 or £15,000 in quieting and reconciling the refractory clans. The Edinburgh authorities issued a proclamation exhorting the clans to submit to William and Mary, and offering pardon to every rebel who would swear on or before Dec. 31, 1691, to live peaceably under the government of their majesties, and threatening to treat all who refused to do so as enemies and traitors. All the chiefs submitted before Dec. 31 except MacIan, the chief of the Macdonalds of Glencoe, whose submission, from unforeseen causes, was delayed till Jan. 6. The magistrate before whom he took the oath of allegiance transmitted a certificate to the council at Edinburgh, explaining the circumstances of the case. That certificate was never laid before the council, but was suppressed by an intrigue, directed (it is supposed) by the master of Stair (sir John Dalrymple, afterwards second viscount and earl of Stair), on whom, undoubtedly, rests the chief blame of this odious transaction. The enemies of MacIan now hurried on their plans for his destruction. The master of Stair obtained the king's signature to an order directed to the commander of the forces in Scotland, and which runs thus: "As for MacIan of Glencoe and that tribe, if they can be well distinguished from the other Highlanders, it will be proper, for the vindication of public justice, to extirpate that set of thieves." Accordingly, on Feb. 1, 120 soldiers—most of them Campbell's, who had a personal spite against the Macdonalds—led by a capt. Campbell and a lieut. Lindsay, marched to Glencoe. They had been warned by Stair to do nothing by halves; they were exhorted to be "secret and sudden;" and they obeyed their instructions. Arrived in the glen, they told the Glencoe men that they were come as friends, and only wanted quarters. For twelve days the soldiers lived in the glen. Capt. Campbell, or Glenlyon as he was called from the name of his estate, while visiting daily at the chief's house, employed himself in observing carefully what avenues and passes there were by means of which the Macdonalds might escape, and reporting the result of his observations to lieut.col. Hamilton, who was approaching with troops to secure the passes. The morning of Feb. 13 was fixed for the slaughter, and on the night of the 12th, Glenlyon was supping and playing at cards with those whom he meant to assassinate before dawn. At five in the morning the murderous work began. When the day dawned, 38 corpses, among which were several of women, and more dreadful still, the hand of an infant that had been struck off in the murderous tumult, were lying in or around the village in their blood. But the massacre comprehended only a small portion of the tribe, for Hamilton not having come up in time, the passes were open, and about 150 men, and probably as many women, escaped, but only in many cases to perish from cold or hunger among the snows in the high mountain-gorges. When Hamilton did arrive, he was disappointed in finding the work so imperfectly done, and seizing an old Highlander, whom, being above seventy, the other butchers had agreed to let live, murdered him in cold blood. The huts of the village were then set on fire, and the troops departed, driving away with them all the flocks and herds of the glen.

The question as to the share of king William in the guilt of this transaction has been discussed with no little warmth on both sides. Lord Macaulay pleads, in vindication of the king's conduct, that the certificate detailing the submission of MacIan had been suppressed; that he knew the Macdonalds only as a rebellious clan, who had rejected his conciliatory offers; and that, in signing the order for their extirpation, he certainly never intended them to be murdered in their sleep, but merely that their organization as a predatory gang should be broken up.—The scene of the massacre is visited annually by tourists, who are accommodated with conveyances in connection with Hutcheson's steam-vessels from Glasgow.

GLENDOWER, or **GLENDWR**, OWEN, a Welsh chief, who was one of the most active and formidable enemies of Henry IV. of England. He was descended from Llewelyn, the last prince of Wales, and followed the fortunes of Richard II. to the close, when, in 1399, Henry of Bolingbroke usurped the crown and assumed the title of king Henry IV. Taking advantage of Glendower's known attachment to the dethroned monarch, lord Grey of Ruthyn seized part of his land. Glendower's suit for its restitution was dismissed by parliament, and then lord Grey seized the rest of his land. Revenge and despair, conspiring with a martial disposition, and the encouraging prophecies of the Welsh bards, drove him to take up arms, and provided him with followers. In 1400 he commenced operations by seizing the estates of lord Grey. The king ordered his subjugation, and granted his estates to his brother, the earl of Somerset. Glendower's forces were inferior in number to those of his adversaries. He was sometimes victorious, chiefly through surprises, ambushes, and the like, but sometimes defeated, and forced to retire to the hills, where his positions and rude fortifications could not be approached. In 1402, he drew lord Grey into an ambush, and took him prisoner. This

nobleman was ransomed on paying 10,000 marks, and the king, out of jealousy of the earl of March (a boy of ten, the true heir to the crown), or some similar cause, allowed him to pay his own ransom. Immediately on his release, lord Grey married a daughter of Glendower; and it would appear that sir Edmund Mortimer, the uncle of the earl of March, married another, having been captured also a little later by Glendower, in a battle in which 1100 of Mortimer's followers were left dead upon the field. Treason seems to have been falsely imputed to Mortimer as the cause of his defeat; but Henry IV.'s suspicions and Glendower's kindness soon made the treason sufficiently real, for Mortimer induced his sister's husband, earl Percy (Hotspur), to conspire with him and Glendower (now proclaimed prince of Wales) against the government. Percy led with him into the same enterprise the Scotch earl Douglas, whom he had just taken prisoner at Homildon hill. This coalition against royalty ended in the battle of Shrewsbury, in July, 1403, in which the fall of Hotspur and the late arrival of Glendower gave the victory to the king and his forces. In June of the following year, Glendower entered into a treaty with Charles VI. of France against the English. Little came of it, for the next year, Glendower sustained severe reverses, and was driven to wander among the caves of the mountains with a handful of adherents. Another two or three years saw his fortunes somewhat in the ascendant, and they fluctuated in the ordinary levels of the petty warfare of a bold, barbarous chief, with mountains to escape to against the advance of superior civilized numbers, which he could no more resist on the plains than they could destroy him among the mountains. He died a natural death in the house of one of his daughters, on Sept. 20, 1415, aged about 65, having spent the last fifteen years of his life in constant turmoil and warfare. His successes show that he had about the highest talents of his class, and he had their faults also. The popular idea of him is to be found in Shakspeare's *King Henry IV.* From the first, he has been a kind of mythical hero, and the lapse of centuries does not clear up the exact facts of his history. His rebellions were the expiring fires of the independence of Wales, which the English kings had been treading out for nearly a century and a half.

GLENELG is a shallow river of considerable length, which rises in the s.w. part of Victoria, and which, after crossing the boundary into South Australia, enters the Southern ocean between cape Northumberland on the w., and cape Bridgewater on the east. Its mouth is about lat. 30° s., and long. 141° east.

GLENGARRY, a co. in n.e. Ontario, on the St. Lawrence and the Quebec boundary, 462 sq.m.; pop. '71, 20,524. The Grand Trunk, and Montreal and Ottawa railroads intersect. The chief town is Alexandria.

GLENLIVET, a vale or district in the s.w. of Banffshire, extends along the course of the Livet, a small feeder of the Avon, at the distance of about 21 m. s.w. from Huntly. It contains iron ore and lead, and has long been famous for its finely flavored whisky. Here a battle took place between the earl of Argyle and the earl of Huntly in 1594, resulting in the defeat of the former.

GLENROY, PARALLEL ROADS OF. The Roy is a small stream in the district of Lochaber, Invernessshire, having a course of about 15 m., and falling into the Spean at Inverroy, opposite to Ben Chlinaig, the eastern spur of Ben Nevis. The steep, narrow valley through which the Roy runs is remarkable for having its faces marked with three shelves, which appear as lines running right round it; they are everywhere perfectly horizontal and parallel to each other, and in each case the line on one side of the glen corresponds exactly in elevation to that on the other. The granitic and metamorphic rocks, of which the mountains are composed, are covered with a greater or less thickness of angular fragments and earth, and an examination of the shelves shows that they are worn out of this soft alluvial coating. They almost invariably form a gentle slope from the hillside, and are from 3 to 30 ft. wide. The protrusion of the rocky body of the mountain, and the furrows of mountain torrents, break their continuity, but with these exceptions one or more of them may be traced along the whole valley. The highest, which is 1139½ ft. above the sea-level, is easily followed from the watershed between the Roy and the Spey (which is at the same elevation), along both sides of the valley, as far down as the point at which the valley narrows above Glen Glaster. The second shelf is 80 ft. lower, runs parallel with the first all round the head of the valley, and is continued further down until it includes Glen Glaster. The third line is 212 ft. lower than the second; it may be traced along both sides of Glenroy, and round the mouth of the glen into the valley of the Spean, whose sides, at the same elevation of 847 ft., is marked from within 3 m. of the river Lochy up nearly as far as loch Lagan. What is very curious, the elevation of the highest shelf corresponds with that of the watershed at the head of Glenroy (where it opens towards the valley of the Spey): the second corresponds with the watershed at the head of Glen Glaster (where it opens towards Glen Spean); and the third is at the same level with the valley of passage between Spean and Spey at Muckall. There is yet a higher shelf in the neighboring Glen Gluoy, at an elevation of 1159½ ft. above the sea.

Many attempts have been made to explain the origin of these remarkable shelves. Their forming somewhat level roads around the valley originated the popular notion that they were made for the convenience of the heroes whose exploits are sung by Ossian. Playfair, in 1816, supposed they were aqueducts for artificial irrigation. Mac-

culloch believed them to be the shore-lines of fresh-water lakes, which gradually washed away their barriers, remaining for a longer space at the height of the various shelves. Sir T. D. Lauder embraced and illustrated the same view. Darwin considered that the glens were former arms of the sea, and that the shelves indicated periods of rest in the elevation of the land. Agassiz and Buckland returned to the opinion of Macculloch, but finding no indication or remains of any solid land barrier, they referred the lake to the glacial period, and held that two large glaciers came down from Ben Nevis, the one near the center of the mountain, and the other along the basin of Loch Treig, and that these dammed up the water in the included portion of Glen Spean and in Glenroy. In a paper subsequently published by Mr. David Milne, the lacustrine theory was reverted to, with several new and plausible illustrations. The reader is referred to a work of Mr. R. Chambers (*Ancient Sea-margins*, 1848) for a full account of this remarkable district. He enumerates no less than 21 terraces or shelves, in addition to the four prominent ones already described, at heights varying from 325 to 1495 feet. And uniting all these into a regular series, he endeavors to show that they are owing to the recession of the sea from these glens, and that the intensity of the shore-markings depended upon the angle at which the hill met the water, the nature of the surface of the hill, and the quietness of the water.

GLEN'S FALLS, a village in Warren co., N. Y., on the upper branch of the Hudson river, and on the Rensselaer and Saratoga railroad, 18 m. n.e. of Saratoga springs. It is noted for its cave, water-power, mills, lime, block marble, canal, water-works, beautiful fountain, and handsome soldiers' monument. It has a large iron foundry, machine-shop, gas works, paper-mill, grist-mills, stone sawing-mill, large saw-mills, run by water-power with a total of 42 gates, 6 lath-mills, steam-saw and planing-mills, plaster-mills, lime-kilns, carriage manufactories, a sewing-machine factory, 2 gun-shops, banks, weekly newspapers, a ladies' seminary, an opera house, and churches.

GLENTILT', a deep, narrow valley in the n. of Perthshire, extends in a s.w. direction from the Grampians on the n. to Strathgarry on the s., and is 15 m. in length. Through the bottom of the glen the Tilt rushes with great impetuosity, and the mountains on each side are scored with innumerable torrents. Its upper half is inclosed among mountains of from 3,350 to 3,589 ft. high, and its left boundary is mainly formed by the huge Ben-y-Gloe, which rises from a broad base, and has many summits, the highest being 3,725 ft. above sea-level. The lower half is less wild. This glen is classic ground to the geologist. Two elaborate accounts of its geological phenomena have been published—one by Dr. M'Culloch, to be found in the *Transactions of the Geological Society;* and the other by lord Webb Seymour, which appears in the *Transactions of the Royal Society of Edinburgh.*

GLIDDON, GEORGE R., American Egyptologist, antiquary, and ethnologist, was b. in 1807, in Grand Cairo, Egypt, where his father, John Gliddon, was for many years U. S. consul. He resided for thirty-two years in the valley of the Nile and in the Levant, and had extraordinary opportunities for pursuing those scientific researches to which he appears to have devoted a large portion of his life. He filled for several years, the post of the United States consul at Cairo.

About the year 1840, Mr. Gliddon visited London, Paris, and his own country, to which he had been so entirely a stranger. In the United States, he gave lectures in all the principal cities, from Boston and New York to Mobile and New Orleans, on Egyptian and other oriental antiquities. His earliest work, *Ancient Egypt, her Monuments, Hieroglyphics, History, and Archæology*, etc., was so successful, that 18,000 copies were sold in America alone in three years. It has passed through many editions. He published also, at about the same period, an *Appeal to the Antiquaries of Europe on the Destruction of the Monuments of Egypt; Discourses on Egyptian Archæology; a Memoir on the Cotton of Egypt;* and *Otia Ægyptiaca.*

In the course of his travels in the United States, Mr. Gliddon formed acquaintances with men of science who were interested in his Egyptian researches, and who, in turn, interested him in a broader range of ethnological investigations. Conspicuous among these were Dr. Morton of Philadelphia, distinguished for his craniological investigations; Dr. Nott of Mobile, Ala.; prof. Agassiz, the naturalist; and others. He wished now to avail himself of the advantages of European museums and libraries, but had not the necessary means. He found, however, a generous friend in Mr. Richard K. Haight of New York, who imported costly works from Europe, not then to be found in America, and also furnished him with money for a visit to London, Paris, and Berlin. The results of his studies are to be found in two quarto volumes, published by Mr. Gliddon, with the co-operation of Dr. Nott, and several other savants, both European and American. In 1854 was published *Types of Mankind, or Ethnological Researches based upon the Ancient Monuments, Paintings, Sculptures, and Crania of Races*, etc., by J. C. Nott, M.D., of Mobile, Ala., and George R. Gliddon; and containing papers by Dr. Morton, prof. Agassiz, and Drs. Usher and Pattison of Philadelphia. In 1857 was published, also in a handsome quarto volume, *Indigenous Races of the Earth, or New Chapters of Ethnological Inquiry*, including monographs by M. Alfred Maury, librarian of the French institute; Francis Pulszky, a learned Hungarian; and prof. Meigs of Philadelphia. This work bears also the joint names of Nott and Gliddon; and Mrs.

Gliddon, an accomplished artist, gave her assistance in drawing upon the wood the engravings with which it is profusely illustrated. Just as this work was published, Mr. Gliddon died at Panama, isthmus of Darien, whither he had gone to pursue his ethnological researches.

Mr. Gliddon was an enthusiast, not only in his investigations, but in the advocacy of his theories or convictions, and is unsparing in his criticisms of his opponents. He has labored to prove the great antiquity and diversity of origin of the human races. His works have been severely criticised and condemned by those who hold to popular chronology and the unity of the race. The materials he has brought together are valuable and suggestive; but his treatment of them can scarcely be considered satisfactory; and he is not free from the suspicion of a bias in favor of the enslavement of certain of those whom he considered inferior races.

GLINKA, Michael Ivanovitch, 1804–57; a Russian composer. His thorough musical education did not begin until the year 1830, when he went abroad and staid for three years in Italy, to study the works of old and modern Italian masters. His thorough knowledge of the requirements of the voice may be connected with this course of study. His training as a composer was finished under Dehn, the celebrated contrapuntist, with whom Glinka stayed for several months at Berlin. In 1833 he returned to Russia, and devoted himself to operatic composition. On Nov. 27, 1836, took place the first representation of his *Life for the Czar*. This was the turning point in Glinka's life—for the work was not only a great success, but in a manner became the origin and basis of a Russian school of national music. Subject and music combined to bring about this issue. The story is taken from the invasion of Russia by the Poles early in the 17th c., and the hero is a peasant who sacrifices his life for the czar. Glinka has wedded this patriotic theme to inspiring music. His melodies, moreover, show distinct affinity to the popular songs of the Russians, and for that reason the term "national" may be justly applied to them. His appointment as imperial chapel-master and conductor of the opera of St. Petersburg was the reward of his dramatic successes. His second opera, *Russian and Lyudmila*, founded on Poushkin's poem, did not appear until 1842; but in the meantime he wrote an overture and four *entre actes* to Kukolnik's drama *Prince Kholmsky*. In 1844, he went abroad for a second time, and lived chiefly in Paris and Spain. On his return to St. Petersburg he wrote and arranged several pieces for the orchestra, amongst which the so-called *Kamarinskaya* has achieved popularity beyond the limits of Russia. He also composed numerous songs and romances. In 1857 he went abroad for the third time, and died suddenly at Berlin.

GLIOMA (Gr. glue), a tumor arising from the delicate connective tissue which holds together the nerve substance, either of the brain or other parts, and which has a gummy or glutinous consistency. Its usual seat is the brain or retina. See Tumors.

GLI'RES (Lat. plural of *glis*, a dormouse), in the Linnæan system of zoology, an order of mammalia almost exactly corresponding to the *rodentia* (q.v.) of Cuvier and other more recent naturalists.

GLISSON, Oliver S., b. Ohio, 1809; an officer in the U. S. navy. He was a midshipman in 1826, a lieut. in 1837, a commander in 1855, a capt. in 1862, a commodore in 1866, a rear-admiral in 1870, and retired the next year. He commanded the *Powhatan* during the Japan expedition under commodore Perry.

GLOBE-FISH. See Diodon.

GLOBE-FLOWER, *Trollius*, a genus of plants of the natural order *ranunculaceæ*, having a calyx of colored (yellow) sepals, in number five or some multiple of five, the petals small and linear. There are several species, natives of the colder parts of the northern hemisphere. The common globe-flower, the Lucken Gowan of the Scotch (*T. Europæus*), is the only species found in Britain, and chiefly in the northern parts, where it is one of the finest ornaments of moist grounds and river-banks in somewhat elevated districts. It is sometimes cultivated in flower-gardens. The name globe-flower is derived from the globe-like appearance of the flower. It is a native of all the northern parts of Europe, and also of the Alps.

GLOBES. A globe is a round or spherical body (see Sphere), and in the singular number the word is often used to signify the earth, as in the phrase, "the terraqueous globe;" but by "globes," or "the globes," we usually mean a pair of artificial globes used as a part of school-room apparatus. These globes are hollow spheres of card-board, coated with a composition of whiting, glue, and oil, upon which paper bearing certain delineations is laid. On one of the pair—the *celestial* globe—are represented the stars, so placed that, to an eye supposed to observe them from the center of the globe, their relative position and distance correspond to those actually observed; while on the *terrestrial* globe, the distribution of land and water, the divisions and subdivisions of the former, together with a few of the most important places, are laid down in the positions corresponding to those which they actually occupy on the surface of the earth.

The usual mode of manufacture is as follows: A ball of wood or iron is used as a matrix, and a layer of damped paper is carefully and closely placed upon this, without paste, and other layers are successively pasted over the first one; ordinary card-board is thus produced, but instead of being flat, as usual, it forms a spherical shell. When

sufficiently thick, this is cut into two hemispheres, the section being made in the line of the intended equator. The hemispheres are then taken off the matrix, and again glued together on an axis, and the whiting composition laid on, the outside of which is smoothed and finished to shape in a lathe. The workman has to lay on this composition so as to balance the globe, in order that it may rest at whatever point it is turned. The smooth surface is now marked with the lines of latitude and longitude, and is covered with the paper on which the required geographical or astronomical delineations are engraved. In order to adapt the plane surface of the paper to the curvature of the sphere, it is printed in pieces, small circles for the Arctic and Antarctic regions, and the rest in lens-shaped gores, varying from 20° to 30° of longitude, and meeting these circles which are pasted first. Great care is required in laying on these curved pieces, so that their edges shall meet exactly without overlapping. The surface is then colored, and strongly varnished, and mounted in its frame and stand.

Globes of india-rubber and gutta-percha have also been made, others of thin paper, to be inflated and suspended in a school-room. Betts's paper globes fold up when not in use. Embossed globes show, in exaggerated relief, the elevations and depressions of the earth's surface. Compound globes, including the celestial and terrestrial, are made with an outer glass sphere for the celestial, and orrery mechanism to show the varying relative positions of the sun and moon, etc. As school-room apparatus, globes are used for the purpose of illustrating the form and motion of the earth, the position and apparent motion of the fixed stars, and for the mechanical solution of a number of problems in geography and practical astronomy. For this purpose, each globe is suspended in a brass ring of somewhat greater diameter, by means of two pins exactly opposite to each other—these pins forming the extremities of the axis round which it revolves, or the north and south poles. This brass circle is then let into a horizontal ring of wood, supported on a stand, as represented in the article ARMILLARY SPHERE; in which the lines drawn on the surface of globes are also explained. The globes in common use in schools are 12 in. in diameter; those found in private libraries are more frequently 18 inches.

The problems to which the globes are applied are such as: To find when a star rises, sets, or comes to the meridian on a given day at a given place. The mode of solution will be found in any school-book on the subject. The answers obtained in this way to such questions are only very rough approximations, and are in themselves of little or no value. But the "use of the globes," as it is called, serves the purpose of making evident to the senses how many of the appearances connected with the motions of the earth and the heavenly bodies are caused, and enabling the nature of the problems connected with these appearances to be clearly conceived. It is only by trigonometrical calculation that the accurate solutions can be obtained.

GLOBIGERI'NA, the name applied to a genus of protozoa (q.v.) belonging to the order foraminifera (q.v.), the shells of which form the great bulk of the calcareous ooze or mud found in the bed of the ocean. The body of globigerina is composed of simple protoplasm, inclosed in a shell of minute and irregularly arranged spheres of lime, through *foramina* or apertures in which are exuded filaments (*pseudopodia*) of the animal substance. The pseudopodia are used in locomotion and the capture of food. Globigerina live in the upper strata of the ocean, and the shells are covered with fragile spines, which drop off as the organism dies and sinks to the sea-bed. Hence the shells were formerly described as without spines. The calcareous matter deposited in this way at the bottom of the ocean can be shown to be merely chalk in a non-consolidated state, and thus gives us direct illustration of the process of chalk-formation. *G. bulloides* is the common species.

GLOB'ULINE, or CRYS'TALLINE, is one of the proteine bodies or albuminates. In association with hæmatine, as hæmato-globulin, it is the main ingredient of the blood globules; and it occurs, mixed with albumen, in the cells of the crystalline lens of the eye, forming, according to Simon, from 10 to 14 per cent of the dry lens. Hence its two names. In most of its relations it resembles albumen, but differs from that substance in being precipitated both from acid and alkaline solutions by exact neutralization, and in being completely thrown down from its solutions by carbonic acid gas.

GLOBULINE, or GLOBULIN, and GLOBULINS. Globuline, as it was spelled until recently, was considered in the earlier stages of scientific physiology the proteine principle of the red blood corpuscles. According to an analysis of Lehmann, it constitutes about 282 parts in 1000 of the blood globules, water constituting 688 parts, the remainder being composed of hæmatine, 17 parts; alkaline salts, 8 parts; with some fatty and extractive matter. This globuline is insoluble in the plasma of the blood, but is soluble in water and diluted blood. Rollet, by alternately freezing and thawing blood and repeating the operation several times, caused the hæmatine to separate from the red corpuscles. By this operation the blood loses its opacity, and the decolorized globules are seen floating in the darkly colored though transparent serum. Views in regard to the constitution of the red blood corpuscles have undergone considerable change within the last twenty years, different modes of analysis having been employed to separate the organic constituents. This globuline of the older physiologists is now considered as a constituent of *hæmoglobin*, which is the proteid substance united with the hæmatine

(see HÆMOGLOBIN). The proteid which is precipitated when a solution of hæmoglobin is exposed to the air, though belonging to the globulin family, has characteristics of its own. Preyer calls it *globin*. It contains no trace of mineral matter, and therefore, when burned, yields no ash. What are now called globulins constitute a family. To understand their relations to other proteine bodies, see PROTEIDS. These globulins are native proteids which differ from albumins in not being soluble in distilled water, needing for their solution a minute portion of a neutral salt, such as chloride of sodium (common salt), differing in this latter respect from the albumins, but are like them in not being soluble in distilled water. The globulins are soluble in dilute acids and alkalies, being changed respectively into acid-albumin and alkali-albumin. The globulins are named as follows:

1. *Globulin*, called also *crystallin*. If the crystalline lens of the eye is rubbed together with fine white sand, digested with water, and filtered, the filtrate will contain three proteids. If carbonic acid gas is now passed through the clear solution, a copious precipitate of *globulin* will take place. In its general behavior globulin much resembles *para globulin* and *fibrinogen*. It is readily precipitated on the addition of alcohol. It resembles vitellin in not being precipitated by saturated solution of chloride of sodium.

2. *Paraglobulin* or *fibrinoplastin*. When blood serum is diluted with 10 parts of water, and carbonic acid gas is rapidly passed through it, a flocculent precipitate is formed, which becomes granular, and easily separable by decantation or filtration. It should be washed with water containing carbonic acid to prevent redissolving. A more complete separation from serum may be effected by saturation with sulphate of magnesia. This yields, according to Hammarsten, about 4.565 parts in 100; but the amount varies in different animals. A characteristic test of paraglobulin is that it produces fibrin when added to many pathological fluids, such as that of the transudations in hydrocele, pericarditis, peritonitis, and pleuritis. Paraglobulin occurs chiefly in blood serum, but is also found in the white corpuscles, in connective tissue, cornea, aqueous humor, lymph, chyle, and serous fluids.

3. *Fibrinogen*. This body much resembles paraglobulin in its behavior generally, but the two differ in regard to coagulation by heat. In a weak solution of chloride of sodium, fibrinogen coagulates at from 125° to 131° F., while paraglobulin requires for coagulation a temperature of 154° to 158°. The characteristic test for its presence is the formation of fibrin when its solution is added to a solution of paraglobulin and fibrin-ferment. Fibrinogen occurs in blood, chyle, and various transudations.

4. *Myosin*. This form of globulin is the chief constituent of dead, rigid muscle. If a dead muscle, from which all fat, tendon, connective tissue, etc., has been removed, is rendered bloodless by a saline injection, and then cut fine and washed with water, when the washing has been continued until no proteid can be detected in the fluid, a large portion of the muscle will remain undissolved; but it will become a viscid mass if treated with a ten per cent solution of chloride of sodium (common salt). If this be placed upon a filter, a filtrate will slowly separate, and if it be allowed to drop into a large quantity of distilled water, a white flocculent precipitate will result, which is *myosin*. It is not as soluble as paraglobulin. It coagulates at a temperature of 131° to 140° F. In some of its reactions it resembles fibrin.

5. *Vitellin*. This is the chief proteid constituent of the yolk of egg, from which it may be obtained as follows: The yolk is treated with ether repeatedly till no coloring matter is extracted, when the residue is dissolved in a ten per cent solution of chloride of sodium, and filtered. The filtrate, when added to an excess of water, causes a precipitate of *vitellin* and some other matters, from which it may be separated by alcohol, which coagulates the vitellin. It is a white, granular body, insoluble in water, but very soluble in dilute solution of chloride of sodium, much more so than myosin. It coagulates between 158° and 176° F. A saturated solution of chloride of sodium causes no precipitate. In yolk of egg vitellin is always associated with lecethin (q.v.), probably in combination. Before it is freed from this body, vitellin possesses properties considerably differing from those of the other proteids.

GLO'BUS HYSTER'ICUS, or ball in the throat, the name applied to a peculiar sensation described under HYSTERIA.

GLOCKNER, or GROSS GLOCKNER, the highest peak of the Noric Alps, is situated on the boundary between Tyrol, Carinthia, and Upper Austria, and is 12,431 ft. in height.

GLO'GAU, or GROSS-GLOGAU, a t. and important fortress of Prussia, in the province of Silesia, is situated on the left bank of the Oder, 35 m. n.n.w. of Liegnitz. It is surrounded by walls, and is otherwise fortified; and is connected by a wooden bridge with a strongly fortified island in the Oder. It has a beautiful castle, two gymnasiums, one Catholic, and the other Protestant. On the island in the Oder is a cathedral dating from 1120, and containing a Madonna, the masterpiece of the elder Cranach. Manufactures of machinery, iron, pottery, bone-dust, tobacco, sugar, etc., and some trade and commerce are carried on. Pop. '75, 18,062, including a garrison of above 3,000 men.

GLOG'GNITZ, a small t. of Austria, in the province of Lower Austria, is situated on the Schwarza, at the northern base of the Semmering Alp, a branch of the Noric chain,

45 m. s.s.w. from Vienna. Pop. '71, 1961. It is a station on the Vienna and Trieste railway, and stands at the northern extremity of that portion of it known as the *Semmeringbahn*, or railway of the Semmering. This portion of railway is perhaps the most extraordinary work of its kind in Europe. It sweeps up the steep rocky face of the mountain in many curves, and descends its southern slope, after having passed through 15 tunnels and crossed as many bridges. It extends from Gloggnitz on the n. to Mürzzuschlag on the s., a distance of 25 miles. The greatest elevation is reached 23½ m. s. of Gloggnitz, where the line is 2,872 ft. above sea-level, and 1504 ft. above its height at Gloggnitz. To this point the line rises in gradients of from 1 in 40 to 1 in 100; the average rate of ascent, however, is 1 in 82. At its greatest elevation, the line pierces the Semmering in a tunnel 4,633 ft. long. Quick trains take 1 hour and 42 minutes to traverse these 25 m.; slow trains require 2 hours 33 minutes. The *Semmeringbahn* was constructed for the Austrian government by Carlo Chega, an eminent engineer, between the years 1848 and 1853.

GLOM'MEN, or STOR-ELV (i.e., *great river*), the largest river in Norway, rises from lake Aursund, at the town of Röros, in lat. about 62° 40' n., and long. 11° 16' east. Its source is 2,419 ft. above sea-level, and its course is interrupted by frequent water-falls, the last of which, with a descent of 60 ft., is called the Sarpenfos or Sarp-fos, and occurs at about 10 m. from the mouth of the river. Large boats can ascend to the Sarpenfos. The Glommen flows first in a s.w. direction for about 50 m., then bends towards the s.e., and pursues that direction until it passes the fortress of Kongsvinger, after which it again turns s w., and empties itself into the Skager Rack at Frederickstadt, after a course of about 320 miles. Its most important affluents are the Rena on the left, and the Vormen on the right.

GLO'RIA, a hymn in the Roman Catholic church service, beginning with the words, "*Gloria in excelsis Deo.*" Its place in the mass is after the "Introitus," except on the penitential days in Advent and during Lent, when it is omitted. It is founded on the 2d chapter of St. Luke, 14th verse. It has been so long in use that it is not known by whom it was introduced into the service in its present form. It is also called "The Great Doxology," to distinguish it from the "*Gloria patri, filio et spiritui,*" sung at the end of the Psalms and antiphonal hymns.

GLO'RIA (*ante*) is the designation given to the words and the music of several doxologies: 1. *Gloria in excelsis*, named from its first words, which are the Latin for *Glory be to God on high.* It is called the *greater doxology*, to distinguish it from the *Gloria Patri;* also the *angelic hymn*, because the first part of it was sung at Bethlehem by the heavenly host. The authorship of the latter part is uncertain, though some have ascribed it to Telessphorus, bishop of Rome, about 139 A.D. It has been used in the eastern church more than 1500 years, and in the church of England more than 1200. It is placed at the beginning of the communion service in the Roman missal, and at the close of it in the rituals of the Anglican, Protestant Episcopal, and Methodist Episcopal churches. 2. *Gloria Patri*, the *minor doxology*, named also from its first words, which are the Latin for *Glory be to the Father.* In the earliest age of Christianity there was no general form of doxology, but each minister and church offered it in varied language, as occasion prompted, ascribing honor and glory to the Father only, to the Son only, or to both. With the rise of Arianism, attention was drawn to the advantage of precision and uniformity, and the formula, *Glory be to the Father, and to the Son, and to the Holy Ghost*, became general. To this the western church added *As it was in the beginning, is now, and ever shall be, world without end.* A modification sometimes used by Unitarians is, *Glory be to the Father, through the Son, and by the Holy Ghost.* For direct praise, and for a leading recognition of the oneness as well as of the trinity of God, the form has been suggested, *Glory be to thee, O God! the Father and the Son and the Holy Ghost.* 3. *Gloria tibi* are the first words of a still briefer form, *Glory be to thee, O Lord!* which is used at the end of sentences or psalms.

GLORIO'SA, a genus of plants of the natural order *liliaceæ*, having a perianth of 6 elongated and reflexed segments, a 3-lobed stigma, a 3-celled superior germen, and globose seeds. The best known species, *G. superba*, a native of India, is a herbaceous perennial with a weak stem, 6 to 10 in. high, alternate leaves terminating in tendrils, and very beautiful flowers, finely colored with red and yellow.

GLORIOUS VIRGIN, or ST. MARY THE GLORIOUS, an order of knighthood in Venice, founded by Bartholomew of Vicenza, and approved by pope Urban IV in 1262. This institution was ecclesiastical as well as military, and its objects were the protection of widows and orphans, and the furtherance of the peace of Italy. The badge was a purple cross between certain stars, and the costume a white surcoat on a russet cloak.

An order of knighthood of St. Mary the Glorious also existed in Rome in the 17th c., whose purpose was the suppression of the Barbary corsairs who infested the Mediterranean.

GLORY PEA, a plant of the genus *clianthus* and order *leguminosæ*, found in the desert regions of Australia. The flowers grow in clusters from the axils of the leaves, and are peculiar in form and rich in color. The petal of the flower is in the form of an elongated shield, and of a brilliant scarlet color, with a central boss of dark brown.

GLOSS (in biblical criticism), Gr. *glossa* (tongue or language), an explanation of purely verbal difficulties of the text, to the exclusion of those which arise from doctrinal, historical, ritual, or ceremonial sources. The words which are commonly the subject of these glossarial explanations are reducible to five classes: (1) foreign words; (2) provincialisms or dialects; (3) obsolete words; (4) technical words; and (5) words used by the author in some abnormal or exceptional signification. From an early period, these verbal difficulties were the object of attention, and the writers who devoted themselves to the elucidation were called *glossatores*, and their works *glossaria*. The principal Greek glossatores are Hesychius, Zonaras, Suidas, Phavorinus. Most of the Rabbinical writers have done the same work for the Hebrew text; so that it would be difficult to name any in particular as Hebrew glossatores. The chief glossatores of the Latin Vulgate are the celebrated Walafried Strabo in the 9th c., and Anselm of Laon, who continued Walafried's work in the 12th century.

In Roman and canon law, the practice of introducing glosses was of early origin, and probably was an imitation of the biblical glosses. Among jurists, the gloss was not purely verbal, but regarded the true interpretation of the law, and in some cases it was held to be of equal authority with the text itself. From the position which it occupied in the MS., being generally written between the lines of the text and on the margin, it was called *glossa interlinearis*. The gloss of the Roman law is written in very pure Latinity, that of the canon law in the Latinity of the mediæval schools.

GLOSSI'TIS (Gr. *glossa*, the tongue), inflammation of the tongue. The disease in its most acute form is rare; it is sometimes due to injury, or to scald; in other cases, to the action of mercury on the system. The tongue becomes enormously swollen, and one of the chief dangers of the attack is suffocation from swelling of the parts about the hyoid bone, and closure thereby of the glottis (see LARYNX). The only really effective treatment is to make pretty deep incisions into the inflamed part, keeping in view that the resulting wound is likely to be much less than appears at the time; for the enlargement of the organ has stretched the mucous membrane, and infiltrated all the textures with fluid, while the vessels also are distended with blood. A straight bistoury should be boldly plunged into the upper surface, and several incisions made lengthways sufficiently deep to evacuate the confined fluids. A good deal of blood will usually follow, but if care has been taken not to injure the lingual artery or its branches (see TONGUE), there is no real danger from this cause. In places at a distance from medical advice, this operation might require to be performed by unskilled hands, and with a penknife or any other cutting instrument at hand; care should be taken in this case to make the incisions on the upper surface, and not too far from the middle line.

GLOS'SOP, a t. of Derbyshire, England, 19 m. w.n.w. from Sheffield, on a small river which falls into the Etherow, a branch of the Mersey. A branch railway, about a mile in length, connects it with the main line of the Manchester, Sheffield, and Lincolnshire railway. It is situated in the midst of the beautiful scenery of the Peak, on a rising ground, above a deep valley, the Dinting vale, over which the railway is carried by a viaduct of 16 arches. The suburb of Howard's town exceeds the older town of Glossop in magnitude. Glossop is the chief seat of the cotton manufacture in Derbyshire. There are also woolen and paper-mills, dye-works, print-fields, bleach-fields, and iron-foundries. The parish church of All-Saints is an ancient edifice, recently enlarged and improved. Pop. '71, 17,046.

GLOTTIS. See LARYNX.

GLOUCESTER, a co. in s.w. New Jersey, on the Delaware river; about 300 sq.m.; pop. '70, 21,562. The surface is level, and for the most part covered with pine forests. It is intersected by the West Jersey railroad. Co. seat, Woodbury.

GLOUCESTER, a co. in e. Virginia, on the Chesapeake bay and York river; 280 sq.m.; pop. '70, 10,211—5,299 colored. The surface is level and the soil productive. Co. seat, Gloucester Court-house.

GLOUCESTER, a co. in n.e. New Brunswick, on the gulf of St. Lawrence and bay Chaleurs; 1684 sq.m; pop. '71, 18,810, of whom about two thirds were of French origin. The surface is rough, with many hills, separated with fertile valleys. The county is crossed by the Intercolonial railway. Ship-building, fishing, and other trade by sea are among the chief employments.

GLOUCESTER, a city and co. in itself, the chief t. of the co. of the same name, an inland port, cathedral town, watering-place, and the seat of some important manufactures, situated on the left bank of the river Severn, distant w.n.w. from London 107 m. by road, and 114 by rail, and from Bristol 36 m. n.n e. Gloucester is clean, and well built, with four principal streets, of convenient width, meeting at right angles in the center of the city. The docks are spacious, and communicate with the open part of the Severn, below Sharpness point, by means of a ship-canal 17 m. in length, while the wharfs, about 1000 ft. in length, are directly connected with the several railways. The foreign trade is principally with the Black and Baltic seas, Canada, the West Indies, and France. In 1875, there entered, in the foreign and colonial trades, 728 vessels, with an aggregate tonnage of 218,261 tons; cleared, 248 vessels, of 92,212 tons. Coasting-trade: inwards, 4,403 vessels, 194,248 tons; outwards, 4,909 vessels, 297,985 tons. The rail-

ways of Gloucestershire belong almost entirely to the Great Western and Midland systems; the latter connecting Gloucester with the n., s., and w.; the former, with London and the e., and with Wales. Besides affording a market for the produce of the surrounding districts, Gloucester imports corn, timber, wines, and spirits in considerable quantities, has a large export trade in iron and steel goods, coal, soap, malt, and potter-ware, railway fittings, agricultural implements, bells, pins, chemicals, and hempen goods.

The principal building in Gloucester is the cathedral, which has been lately completely restored at a cost of from £65,000 to £70,000. The cathedral is 427 ft. in length, and 154 in width; the height of the central tower, its greatest external ornament, is 223 ft.; the cloisters also, of great beauty, form a large square. Formerly the church of a Benedictine abbey, it was converted into a cathedral in 1541. Near it is the new bishop's palace. There are 12 churches of the Establishment; 4 Wesleyan and 2 Independent chapels; 1 Catholic, Baptist, Methodist, Friends, Unitarian, and lady Huntingdon's chapel; a grammar-school, theater, assembly rooms, shire-hall, town-hall, jail, and lunatic asylum. Gloucester returns two members to parliament. Pop. '71 of municipal borough, 18,340; of parliamentary borough, 31,844. It is noted as one of the three cities (Worcester and Hereford being the other two) at which the musical festivals of the three choirs are alternately held. The history of Gloucester is traceable to a very remote antiquity; it was the Caer Glow of the Britons, Colonia Glevum of the Romans, and an important town in Mercia under the Saxons, by whom it was called *Glean-Ceaster*—whence its present name. Here the celebrated single combat between Edmund Ironsides and Canute is said to have taken place. Gloucester was repeatedly visited by William I., afforded a refuge and support to queen Matilda in her contest with Stephen, saw Henry III. crowned, and parliaments held under Richard II. and Henry IV., and sided successfully with the parliament in the civil war against Charles I. Robert of Gloucester, the metrical historian; Miles Smith, biblical translator; the poet Taylor; and R. Raikes, the promoter of Sunday-schools, were natives of Gloucester.

GLOUCESTER, a city, seaport, and fishing-station of North America, in the state of Massachusetts, is situated on the s. side of cape Ann, about 28 m. n.e. of Boston. It is handsomely built and finely situated, and commands extensive sea-views. Its "harbor," one of the best on the coast, is roomy, safe, easily accessible, and deep enough to admit vessels of the largest size. Gloucester is said to be the first fishing-town in the United States. The fishing boats and vessels belonging to the port employ between 3,000 and 4,000 men. Gloucester, which was incorporated as a town under its present name in 1624, has 3 national banks, above 20 public schools, and 2 weekly newspapers. It has extensive manufactories of anchors, cables, sails, oil, soap, candles, and provisions. Gloucester, which is connected with Boston by a branch-railroad, has recently become a favorite resort for sea-bathing. Pop. '55, 8,935; '70, 15,389; '75, 16,754; '80, 19,329.

GLOUCESTER CITY, in Camden co., N. J., on the Delaware river, connected by ferry with Philadelphia, and accessible by two railroads; pop. '70, 3,682. The principal business is manufacturing.

GLOUCESTERSHIRE, a co. of England, lying around the lower course of the Severn and the estuary of that river, is bounded on the w. by Monmouth and Hereford, on the n. by Worcester and Warwickshire, on the e. by Oxford and Berks, and on the s. by Somerset and Wilts. Area, 804,977 acres; pop. '61, 485,502; '71, 534,640. The shape of the county resembles a parallelogram, and though its outline is still somewhat irregular, especially in the n., it is much less so than formerly, as by act 7 and 8 Vict. c. 61, outlying portions of the county of Gloucestershire were annexed to the counties in which they were respectively situated; and, in like manner, detached pieces of land belonging to other counties, but situated in Gloucestershire, were declared portions of that county. There are three distinct districts in this county, the natural features of each being different. These are the Hill, the Vale, and the Forest districts; the first formed by the Coteswold or Cotswold hills (q.v.); the second, comprising the vales of Gloucester and Berkeley, by the rich and low meadow-lands lying along the banks of the Severn; and the third consisting of the land w. of the Severn, which is occupied chiefly by the forest of Dean. The county is watered principally by the Severn, the Wye, the upper and lower Avon, and the Thames or Isis, which receives all the streams on the e. of the Cotswold hills. The soil is thin on the hills, but produces good pasturage for sheep, while the lower tracts abound in excellent grass and arable lands. Gloucestershire is famous as a dairy county, and raises large numbers of cattle. The famous double and single Glo'ster cheese is produced in the vale of Berkeley. The forest of Dean, 20,000 acres of which are still crown property, is highly picturesque in appearance. From the orchards of Gloucestershire enormous quantities of cider are obtained. In 1878 there were in Gloucestershire 648,795 acres under cultivation, 172,515 acres being under corn crops. Gloucestershire is also a great coal and iron producing county. There are about eighty collieries; in 1874 the forest of Dean iron mines raised 171,428 tons of iron ore. The manufactures are numerous and important. The chief is the manufacture of woolen cloth of the finer qualities; hats, felt, stockings, pins, cheese-cloths, and other linens are also produced in considerable quantities. The county sends four members to the house of commons.

Gloucestershire, previous to the Roman invasion, was inhabited by a tribe called the

Dobuni; and after that event, the county, or the greater part of it, was included in the province named *Flavia Cæsariensis.* From the earliest of the Danish invasions down to the battle of Tewkesbury, in 1471, and to the civil wars between the crown and parliament, Gloucestershire has been the scene of many and disastrous encounters. It contains numerous Roman relics in camps, roads, coins, fragments of statuary and pottery, tesselated pavements, etc. There are also very numerous traces of British works in the county.

GLOVER, RICHARD, was b. in London in 1712, and was educated at Cheam, in Surrey. He was a merchant in his native city and, in 1760, became member of parliament for Weymouth. His first poem, to the memory of sir Isaac Newton, was written in his 16th year. His chief poem, entitled *Leonidas,* was published in 1737, and passed through several editions. A continuation of it, the *Atheniad,* was published in 1787. These poems are in blank verse, and of prodigious extent. Although not deficient in a certain majesty and elevation of tone, they are in the main turgid and heavy, and are now almost entirely forgotten. He wrote several tragedies, which did not meet with success. His most popular poem, *Hosier's Ghost,* written on the taking of Carthagena from the Spaniards, was published in 1739. He died in 1785; and in 1813, appeared a diary, or part of a diary, written by him.

GLOVERSVILLE, a village in Fulton co., N. Y., the n. terminus of the Fonda. Johnstown, and Gloversville railroad, which connects at Fonda with the N. Y. Central; 53 m. n.w. of Albany; pop. '80, of Johnstown township, which includes Gloversville, 16,626. It contains over 150 glove manufactories, and produces two-thirds of all the buckskin and kid gloves made in the United States. There are also manufactories of glove patterns, organs, railroad lamps, carriages, kid and other leather machines, and two large foundries. There are 6 churches and 2 national banks. A horse-railroad connects the village with Johnstown, and there are waterworks and gas.

GLOVES. Gloves are made of various materials, such as silk, wool, linen, cotton, fur, and various kinds of leather. The latter material is the most abundantly used, and the mode of making it up is the most characteristic of this branch of manufacture. We need scarcely inform the reader that the term "kid" is a mere technicality, as the quantity annually consumed of leather bearing this name is largely in excess of what could be supplied from the skins of all the young goats that are annually slaughtered. It is chiefly made from lamb's skin. A few of the finest gloves are made from real kid skins, obtained from those countries where goats' milk and flesh are articles of food. Dogskin, buckskin, and doeskin gloves are made chiefly from sheepskin; some of the thickest kinds of leather gloves are made from calf-skin. The leather in all cases undergoes a much lighter dressing than when used for boots and shoes.

Worcester is the chief seat of the English leather glove-manufactory; gloves are also made at Ludlow, Leominster, and Yeovil, besides Woodstock, where a peculiar and superior doeskin glove is made bearing the name of the town. Limerick and the neighborhood has long been celebrated for gloves.

The French, however, still excel us in this branch of manufacture. Up to 1825 the importation of French gloves was prohibited, and the competition consequent upon the removal of this prohibition had the usual effect of producing a rapid improvement in the English manufacture. Very cheap and good gloves are made at Naples; and they are much in request on the continent.

After the leather has been properly prepared, it is cut into pieces of the required size, then folded over somewhat unequally, as the back should be larger than the front. Three cuts are then made through the doubled piece to produce the four fingers; an oblong hole is cut at the bending of the fold for the insertion of the thumb-piece: the cutting of this of the exact shape and size requires considerable skill. The first and fourth fingers are completed by gussets or strips sewed only on their inner sides, while the second and third fingers require gussets on each side to complete them. Besides these, small pieces of a diamond shape are sewed in at the base of the fingers towards the palm of the hand. The stitching together of these pieces requires much care, as the junction must be made as closely as possible to the edge of each piece, and yet with sufficient hold to keep the stitches from cutting through the material. A kind of vise or clamp, with minute teeth to regulate the stitches, is sometimes used for this purpose; and sewing-machines are applied as far as practicable, especially for the ornamental or embroidery stitching on the backs. The putting in of the thumb-piece requires special skill and management. Badly made gloves commonly give way at this part. The superiority of the French and the best English gloves depends chiefly upon the adaptation of their shape to the structure of the hand by giving additional size where the flexure of the hand requires it. The best woolen, thread, and silk gloves are made as above by cutting and sewing together, but commoner gloves are made to a great extent by knitting and weaving in like manner to stockings.

Glove-dyeing.—The dye is lightly washed over the stretched glove, a second and third coat being given after the first is dry. When this is thoroughly dried, the superfluous color is rubbed off, and the surface smoothed by rubbing with a polished stick or piece of ivory. The surface is then sponged over with the white of egg.

Glove-cleaning.—Oil of turpentine or camphine was the material chiefly used for

cleaning kid gloves, but of late this has been to a great extent superseded by benzole (q.v.) or benzine, which is abundantly obtained in sufficient purity for this purpose by the careful rectification of coal-naphtha. The chief advantages of this latter material are, that it is more volatile, and its odor less persistent than that of ordinary turpentine, or even of the best rectified camphine which has been much exposed to the atmosphere. The mode of using either of these is to stretch the gloves over a wooden hand of suitable size, and then sponge them with the fluid, removing the first or dirty portion with a second wash of clean fluid. By collecting the washings separately, and allowing them to stand till the dirt settles, the same turpentine or benzole may be used over and over again.

An inodorous composition may be made by dissolving one part of soap-shavings in two parts of rain or distilled water, using heat to aid the solution. This is improved by adding to it a small quantity of liquor ammonia and any ordinary perfume. It should be applied to the glove stretched on the stock by rubbing with a piece of flannel always in one direction.

Doeskin and wash-leather gloves, when not very dirty, may be cleaned dry by rubbing them when stretched on a stock with a mixture of finely powdered fuller's-earth and alum, then sweeping off this powder with a brush, and dusting with dry bran and whiting. If the gloves are very dirty, they should be washed with the soap solution, then rubbed with pipe-clay mixed with yellow ocher or amber (according to the shade required), made into a paste with ale or beer, then carefully dried and dusted to remove the superfluous powder.

Glove Powder, for cleaning gloves, is made by carefully drying Castile soap, and then pounding it in a mortar; or of pipe-clay covered with yellow ocher or Irish slate, or it may be made of a mixture of pipe-clay and powdered soap.

GLOVES (in law). It is an old custom in England on a maiden assize—i.e., an assize on which there is no offender to be tried—for the sheriff to present the judge with a pair of white gloves. The clerk of assize and the judges' officers have money given to them on the same occasion, which is called *glove* silver. The custom of presenting white gloves to the judges on a maiden circuit is also observed in Scotland.

GLOWWORM, the name given to the wingless females of certain coleopterous insects of the family *lampyridæ*, remarkable for the luminosity of some of the last segments of the abdomen. The insects of the family *lampyridæ* have five joints in all the *tarsi*, the antennæ toothed, the elytra (wing-covers)—at least of the males—covering the whole abdomen, the whole body soft and the elytra flexible, the females often destitute both of wings and elytra, the thorax projecting over and almost concealing the head. When seized, they place their feet and antennæ close to the body, many of them also curving the abdomen downward, and simulate death. The COMMON GLOWWORM (*Lampyris noctiluca*) is abundant in some parts of England, and rare in the s. of Scotland. The antennæ are short. The male has very large eyes. The female, which is larger than the male, is fully half an inch in length, of a blackish color, the legs dusky red, and the thorax and abdomen margined with that color. The female is perfectly destitute both of wings and elytra. The habits of the insect are nocturnal. The male emits a faint light, the female a soft but strong light, of which the use is supposed to be to attract and guide the male. The female glow-worm is generally to be found, during the summer months, among grass, or on mossy banks. There is reason to think that the glow-worm has the power of displaying and extinguishing its light at pleasure, so that it may not be unnecessarily exposed to enemies; but if the luminous portion of the abdomen be removed, it retains its luminosity for some time. If placed in hydrogen gas, it sometimes detonates. The luminous matter is capable of being mixed with water, and warm water increases its brilliancy. Two spots on the last segment of the abdomen are more luminous than any other part, and a constant motion of this segment seems to be connected with the emission of the light. The two segments next to this are each surrounded by a band brighter than the rest of the segment. The larva of the glow-worm is very similar to the perfect female insect, but is very faintly luminous. It is very voracious, attacking and devouring snails, whereas the perfect insect eats little, and is supposed to prefer the tender leaves of plants.—Several species of glow-worm are found in the warmer parts of Europe, and in other parts of the world. The luminosity of the males of the genus *lampyris*, and of other winged insects of the family *lampyridæ*, has obtained for them the name of fire-flies (q.v.).

GLUCHOV, a t. in the s.w. of Russia, in the government of Tchernigov, and 112 m. in direct line e.n.e. of the town of that name. It is surrounded by earthen walls, contains eight churches, has manufactures of cloth, and some trade in grain and brandy. In the vicinity, porcelain clay is obtained, and is sent n. to the imperial manufactory at St. Petersburg. Pop. '67, 10,747.

GLUCI'NA (more correctly, GLYCINA, from Gr. *glykys*, sweet), derives it name from its salts having a sweetish taste. It was discovered by Vauquelin, in 1797, in the emerald, and has since been found in cymophane, chrysoberyl, phenokite, the gadolinites, leucophane, and belvine; but in consequence of the great difficulty of preparing it, its properties and combinations have not been much studied. Berzelius regarded it as the sesquioxide of glucinum (q.v.), in which case its formula would be Gl_2O_3, but it is

now generally believed to be a protoxide, GlO. For the mode of extracting it from the emerald or other mineral containing it, we must refer to Debray's *Memoir on Glucinum and its Compounds* (a translation of which is given in the eighth volume of the *Quarterly Journal of the Chemical Society*), or to any of the larger works on chemistry. Glucina is a white, loosely coherent powder, without taste or smell. It is infusible, but volatilizes at a very high temperature.

Amongst the salts of glucina that have been studied by Debray and others, we may mention the sulphates of glucina, and of glucina and potash; the carbonates of glucina, and of glucina and potash; and the oxalates of glucina, of glucina and potash, and of glucina and ammonia. They are colorless, and much resemble those of alumina.

The mineral *phenakite* is a pure silicate of glucina. The *beryl*, of which the *emerald* is a variety, is a double silicate of glucina and alumina. The mineral *euclase* is also a double silicate of the same earths; while the *chrysoberyl* is an aluminate of glucina, colored with peroxide of iron,

GLUCI'NUM (symbol Gl), known also as GLYCINUM, GLYCIUM, and BERYLLIUM, is a metal whose atomic weight is 4.65 according to the system formerly in use, and 9.4 according to that now generally adopted; its specific gravity is 2.1. It is white, malleable, and fusible below the melting-point of silver. It does not burn in air, oxygen, or sulphur, but in the first two substances it becomes covered with a thin coat of oxide. It combines readily with chlorine, iodine, and silicon. Even when heated to redness, it does not decompose water. It dissolves readily in hydrochloric and sulphuric acids, and in a solution of potash, but is insoluble in ammonia, and only slightly acted on by nitric acid. It forms one oxide, GLUCINA.

From the researches of Debray, it follows that glucinum should be placed side by side with aluminium. These bodies are intermediate between the precious and the ordinary metals, and both of them are characterized by the following properties: They are permanent in the air at high as well as at low temperatures; do not decompose water, even when they are at a white heat; are not attacked by sulphur, sulphureted hydrogen, or the alkaline sulphide; are not attacked by strong nitric acid at ordinary temperatures, and only slowly, even with the aid of heat; but dissolve readily in dilute sulphuric and hydrochloric acids.

Glucinum was first obtained from glucina by Wöhler, in 1827, who procured it by decomposing the chloride of glucinum, which is obtained by evaporating a solution of glucina in hydrochloric acid. Debray has since (1854) obtained it much more abundantly by applying a similar mode of proceeding to that employed by Sainte Claire Deville for the reduction of aluminium.

GLUCK, CHRISTOPH WILLIBALD VON, a German musical composer, who may be considered the father of the modern opera, was b. July 2, 1714, at Weissenwangen, in the Upper Palatinate. He learned the rudiments of music in one of the common schools of Prague, and as a wandering musician went to Vienna, where he found opportunity to master the rules of counterpoint and harmony. In 1738, he went to Italy, to complete his musical education, and found a worthy master in San-Martini. After four years of study he wrote his first opera, *Artaxerxes*, which was performed at Milan, 1741. This was followed by *Ipermnestra* and *Demetrio*, given at Venice, 1742, and several others in the two following years, produced at Milan and Turin. Having achieved a high reputation, Gluck was invited to London, where his *Fall of the Giants* was represented in 1745. He found a formidable rival in Handel, whose genius he honored, and he derived great advantages from the friendship of Dr. Arne, the English composer, and his lady, an excellent singer. It was here that he began to develop the full force of that lyric genius which was destined soon to create a new order of musical composition; but the outbreak of the rebellion in Scotland closed the opera, the singers and musicians being mostly Roman Catholics, and Gluck returned to Vienna. In 1754 he was called to Rome, where he wrote *La Clemenza di Tito*, *Antigono*, and several others. But he did not rise to that high style of art which distinguished his later works until he found at Florence, in Ranieri di Calzabigi, a poet whose dramas were worthy of his music. He then composed the three operas, *Alceste*, *Paride e Elena*, and *Orfeo*, which became the foundation of an imperishable fame. He made music the interpreter of poetry, giving to it the fullest expression. His simple, noble, and grand style filled Europe with admiration. He changed no less the action of the stage than the music. Before him all was artificial and insipid. He made everything natural and effective. At Paris, 1777, he became the rival of the great Italian composer Picini, and the city was divided into two rival factions of the Gluckists and the Picinists. He conquered with his *Iphigénie en Tauride*, 1779. Picini, who had composed an opera on the same subject, would not allow his to be performed after listening to that of his rival. His great triumph was followed by several successful works, and he enjoyed the highest patronage and prosperity. He died of apoplexy, Nov. 25, 1787. Burney has characterized him in a single phrase, when he calls him "the Michael Angelo of music."

GLUCKSTADT, a t. in the Prussian province of Slesvig-Holstein, is situated on the right bank of the Elbe, on the Kremper Marsh, 32 m. below Hamburg. It is a pretty town, regularly built, and intersected by canals. The chief buildings are the high school, the school of navigation, the house of correction, the workhouse for Slesvig-

Holstein, and the theater. It has a safe port capable of containing 200 ships, and furnished with wharfs. The water with which the town is supplied requires to be gathered into cisterns and artificially purified. Weaving is carried on; but trade, navigation, and whale-fishing employ the inhabitants chiefly. Gluckstadt was founded in 1620 by Christian IV. of Denmark, fortified, and endowed with various commercial privileges. During the thirty years' war, it successfully withstood three sieges; its fortifications were demolished in 1815. Pop. '75, 5,043.

GLU'COSE (or, more correctly, GLYCOSE), known also as GRAPE SUGAR, STARCH SUGAR, and DIABETIC SUGAR ($C_{12}H_{12}O_{12}+2aq$), seldom occurs in distinct, well-formed crystals, but may be obtained in warty concretions, which, when examined under the microscope, are found to consist of minute rhombic tablets. It never, however, crystallizes readily. It is less sweet than ordinary (cane) sugar, and is soluble in water and in dilute alcohol. There are two varieties, distinguished by their action on polarized light—*dextroglucose*, which turns the plane of polarization to the right, and *lævoglucose*, which turns it to the left. At 212° it fuses, and loses its water of crystallization, and at a higher temperature (about 400°) it undergoes change, loses the elements of water, and becomes converted into *Caramel* ($C_{12}H_9O_9$), a brown substance, which is neither sweet nor capable of undergoing fermentation, but which is readily soluble in water, and is much used by cooks and confectioners as a coloring matter. At a still higher temperature, it becomes entirely decomposed into carbonic oxide, carbonic acid, light carbureted hydrogen (C_2H_4), acetic acid, aldehyde, furfurol, and a very bitter substance, to which the name *assamar* has been applied.

With bases, glucose forms various definite but unstable compounds, which have been termed *saccharates*, a term which ought to have been restricted to the salts of saccharic acid. On heating an alkaline solution of glucose, decomposition ensues, and a dark-brown uncrystallizable substance is formed, which possesses acid properties, and is known as *melassic acid*. This reaction is sometimes employed for the detection of glucose, and is known as Moore's test.

Glucose has a strong reducing power, and upon this property several of its tests are based. It reduces the oxide of copper, even without the aid of heat, in alkaline solutions to the state of the yellow sub-oxide, and this reaction is apparent when only 0.0001 of glucose is present in the fluid. This is known as Trommer's test, and Fehling's mode of determining glucose quantitatively is based on the same reaction. In consequence of this reducing power, sugar is sometimes employed in the solution of the silver salts used for the silvering of mirrors.

Glucose readily undergoes fermentation. On mixing a solution of it, kept at a moderate temperature, with yeast, each equivalent of it breaks up into two equivalents of alcohol, and four equivalents of carbonic acid, or—

$$\overbrace{C_{12}H_{12}O_{12}}^{\text{Glucose.}} = 2(\overbrace{C_4H_6O_2}^{\text{Alcohol.}}) + \overbrace{4CO_2}^{\text{Carbonic Acid.}}$$

Under the influence of other exciters of fermentation, as, for instance, putrid animal membranes, or other nitrogenous substances, glucose becomes converted first into lactic acid, and subsequently into butyric acid. These reactions are exhibited in the two following formulæ:

$$\overbrace{C_{12}H_{12}O_{12}}^{\text{Glucose.}} = 2(\overbrace{C_6H_6O_6}^{\text{Lactic Acid.}}) = \overbrace{C_8H_8O_4}^{\text{Butyric Acid.}} + \overbrace{4CO_2}^{\text{Carbonic Acid.}} + \overbrace{4H}^{\text{Hydrogen.}}$$

Under certain conditions, which are not accurately known, solutions of glucose undergo a change which is termed *viscous* fermentation. The sugar becomes converted into a viscous or ropy substance, while lactic acid and mannite ($C_{12}H_{14}O_{12}$) are formed. This kind of fermentation sometimes occurs it light-bodied white wines. Water is probably decomposed, and its hydrogen unites with a portion of the glucose to form mannite.

Glucose is a constituent of the juice of grapes, plums, cherries, figs, and many other sweet fruits, and may often be observed in a crystalline form on raisins, dried figs, etc. It likewise occurs in honey. In the animal kingdom, it is found sometimes as a normal and sometimes as a pathological constituent of various fluids and tissues. Thus, it occurs normally in the contents of the small intestine, and in the chyle after the use of amylaceous and saccharine food, in the blood of the hepatic veins (See LIVER), in the tissue of the liver, in both the yolk and white of birds' eggs, in the urinary secretion in minute quantity (according to Brücke, Bence, Jones, and others), etc.; while in the disease known as diabetes, it exists in large quantity in the urinary secretion, and may be detected in nearly all the fluids of the body. By injuring a certain part of the medulla oblongata (the part of the spinal cord contained within the cavity of the cranium), an artificial diabetes can be produced.

The mode of formation of glucose, whether in the laboratory or in the organisms of plants and animals, requires some notice. It can be obtained chemically from starch and from dextrine by boiling them with dilute sulphuric acid, or by the action of diastase (q.v.), and from cellulose and gum, and from most of the varieties of sugar, by treatment with dilute acids. In the liver, it is formed from the glycogen (q.v.) which

occurs in that organ, under the influence of a ferment which has been chemically separated from the hepatic tissue, but with the nature of which we are not acquainted, while in the rest of the organism it is formed from the starch which is taken with the food, the starch undergoing this transformation under the influence of ptyaline (a ferment occurring in the saliva); pancreatine (a ferment occurring in the pancreatic juice), and an unknown but corresponding ferment existing in the intestinal fluid.

The simplest method of preparing pure glucose is by treating honey with cold rectified spirit, which extracts the uncrystallizable sugar; the residue is dissolved in water, and the solution is decolorized with animal charcoal, and allowed to crystallize.

It is manufactured on a large scale, especially on the continent, from starch. A mixture of starch and water at a temperature of about 130° is made to flow gradually into a vat containing water acidulated with 1 per cent of sulphuric acid, and kept at the boiling-point. In about half an hour, the starch is converted into sugar. The liquid is drawn off, and the sulphuric acid is neutralized by the gradual addition of chalk, till there is no longer any effervescence. The sulphate of lime is deposited, and the clear aqueous solution, after being concentrated by evaporation, is set aside to crystallize. The molasses is drained off, and the sugar is dried at a gentle heat in a current of air. "The chief use," says Dr. Muspratt, in his *Chemistry Applied to Arts and Manufactures*, "to which glucose is applied on the continent, is for the manufacture of beer and a coarse kind of alcohol, which is said to be extensively converted into French brandy by the addition of oil of raisins, coloring matter, etc."

As all alcoholic drinks (ales, wines, and spirits) are obtained from fluids containing this variety of sugar as the essential constituent, and as their quality mainly depends upon the amount of sugar that is present, it is very important to have some ready means of determining its amount. A similar determination is also of great value in reference to the urinary secretion in diabetes, as it is mainly by ascertaining whether the daily amount of excreted glucose is diminishing or increasing that we can trace the favorable or unfavorable progress of the case.

Without entering into details, we may mention that there are three different modes of determining the amount of glucose in a fluid: the first is by determining the specific gravity; the second is the optical test, which is based upon the fact (already noticed), that solutions of sugar (whether grape, cane, or milk sugar) exert right-handed rotation upon a ray of polarized light, the angle of rotation being proportional to the percentage of sugar. Soleil's apparatus for determining sugar in this way is described in the article POLARIZING APPARATUS. The third is by chemical means, of which the most important are Barreswil's method and the fermentation test. Barreswil's method is based upon the property which glucose possesses of throwing down suboxide of copper from alkaline solutions of oxide of copper.

In employing the products of the fermentation of glucose as a means of determining its quantity, we take a given quantity of the saccharine fluid, add a little well-washed yeast, and collect the carbonic acid that is evolved over mercury. Roughly speaking, a cubic inch of carbonic acid corresponds to a grain of sugar.

Much information upon the different tests for glucose, and upon their relative degrees of delicacy, will be found in a paper recently published by Dr. Bence Jones in the *Quarterly Journal of the Chemical Society*, 1861, vol. xiv. p. 22.

GLUCOSU'RIA, a modern name for diabetes mellitus (see DIABETES), and indicative of its characteristic symptom, the presence of sugar in the urine.

GLUE. See GELATINE.

GLUE, MARINE, a cementing composition used in ship-building, and for other purposes, where the materials are exposed to the influence of wet. It consists of India-rubber cut very small—one part digested at a gentle heat in a closed vessel with twelve parts of mineral naphtha, until it is dissolved, then twenty parts of powdered shellac are added, and the digestion continued until it also is dissolved. During both stages of the process, the mixture must be stirred or shaken occasionally. It requires to be liquified by heat before using, and must be quickly applied, as it very soon hardens. It is particularly valuable in consequence of its power to cement not only wood, but glass and metals, and also to resist the action of moisture. Its employment, however, requires some care and skill.

GLUME, in botany, a small bract or scale, in the axil of which there grows either a single flower destitute of perianth, as in the *cyperaceæ*, and in some of the grasses; or, as in others of the grasses, a *spikelet* composed of a number of flowers (*florets*). The grasses (*gramineæ*) and *cyperaceæ* are sometimes conjoined under the appellation *glumaceous plants*.

GLÜMER, ADOLF VON, b. 1814; a Prussian officer. In 1866 he took part as a maj.-gen. in the war against Hesse, Hanover, and other southern German states. He was prominent in the Franco-German war, especially at the battle of Saarbrücken. He was also in the battle of Metz, was wounded at Nuits, and was conspicuous in other engagements.

GLU'TEN is one of the most important constituents of the varieties of corn used as food. It is obtained by mixing flour with water, and thus forming a paste or dough,

This paste is placed in a bag of fine linen, and kneaded in water, which must be repeatedly changed, till it ceases to assume a milky appearance. A gray, tenacious, viscous, tasteless substance, having the appearance of bird-lime, is left in the bag. This substance consists mainly of gluten, mixed with traces of bran starch and of oily matter. The gluten thus obtained from wheat and from rye is far more tenacious than that which is obtained from the other cereals, and it is the great tenacity of this constituent that especially fits these flours for conversion into bread. It is found, by analysis, that the proportion of gluten contained in wheat grown in Algeria and other hot countries is considerably higher than in wheat grown in England or still colder countries; and the hard, thin-skinned wheats contain more of this ingredient than the softer varieties of the grain. It forms about 16 per cent of Algerian wheat; about 15 per cent of wheat from the Black sea; and nearly 14 per cent of South Carolina wheat; about 10.7 per cent of English wheat; 9.8 per cent of Canadian wheat; and less than 9 per cent of Dantzig wheat.

Gluten in a moist state rapidly putrefies, the mass acquiring the smell of decaying cheese; but when dry, it forms a hard, brownish, horny-looking mass. that does not very readily decompose. On treating gluten with hot alcohol, we find that it resolves itself into at least two distinct substances, one of which is soluble, and the other insoluble in that fluid.

The insoluble portion is regarded by Liebig as vegetable fibrine. It is a gray, tough, elastic substance, insoluble in water or in ether, but readily soluble in dilute alkalies, from which it is precipitated by neutralization with acetic acid. It is also soluble in very dilute hydrochloric acid, from which it is thrown down by the neutral salts.

The soluble portion is in part precipitated from the alcohol on cooling, in the form of flakes, which have the composition and properties of caseine; while a third substance remains in solution, giving to the alcohol a sirupy consistence. It separates, on the addition of water, as a white substance resembling albumen. It is usually known as *gliadin*, but some chemists—Dumas and Cahours, and others, have termed it *glutine*, a name which is objectionable on the ground that it is already engaged for the chief form of gelatine. All these constituents of gluten contain carbon, hydrogen, nitrogen, oxygen, and sulphur, in much the same proportion as the animal albuminates or proteine bodies, and they all doubtless belong to the flesh-forming group of foods.

The action of gluten in the manufacture of bread is probably a double one; it induces, by constant action, an alteration of the starch, and subsequent fermentation, while by its tenacity it prevents the escape of carbonic acid gas.

GLUT'TON (*gulo*), a genus of quadrupeds usually referred to the bear family (*ursidæ*), but which constitutes an interesting connecting-link between that and the weasel family (*mustelidæ*), agreeing more nearly with the latter in dentition, although approaching to the former in the plantigrade character. There are three false molars in the upper, and four in the lower jaw, anterior to the carnivorous tooth, which is large and sharp. The body is long, the legs are short, the feet have each five deeply divided toes, terminated by long curved claws. The tail is rather short, a fold beneath the tail supplies the place of the glandular pouch of the badgers; but when hard pressed by enemies, the gluttons emit a peculiar fluid of a strong musky odor. Their habits are nocturnal. The species commonly called GLUTTON, and also WOLVERENE (*G. arcticus*), is a native of the northern parts of Europe, Asia, and America. It is more common in the arctic regions than towards the southern limits of its distribution, which are about the forests of Courland, in Europe, and the mountainous parts of Massachusetts, in America. It is about 2 ft. 6 in. or 2 ft. 9 in. in length, from the tip of the nose to the root of the tail; the tail about 7 or 8 in. long, both body and tail covered with long hair, under which the body is covered with a rich thick fur. The general color of the long hair is brown, sometimes approaching to black, lighter bands passing from the neck along the flanks, and meeting at the tail. The short fur is chestnut brown. The muzzle is black. A light-brown band runs across the forehead from ear to ear. The fur of the glutton is sometimes of considerable value, and is used for muffs, cloaks, etc., but varies not a little in glossiness and other qualities. The most extraordinary stories were at one time credited concerning the ferocity, voracity, and cunning of this animal, and have not altogether disappeared from books of natural history. It is very capable of domestication, and even in a wild state exhibits no remarkable ferocity; nor is there any reason to believe that it leaps from trees on deer, or pursues any of those artful methods of procuring food which were once ascribed to it. It often preys on animals which it has not itself killed. The smaller quadrupeds are its principal food, and it devours young foxes in great numbers. Its speed is not great, but it excels in strength and perseverance. The traps set for the smaller kinds of animals in the fur countries of North America are very often robbed by the wolverene, and it has been known to remove a great pile of wood, in order to get at provisions which had been hidden under it.—Closely allied to the glutton are the grison and the ratel. Bone-caverns and some of the newest deposits exhibit remains of more than one species of glutton.

GLYCE'RIA. See MANNA GRASS.

GLY'CERINE ($C_6H_8O_6$), known also as hydrated oxide of lipyl, or hydrated oxide of glyceryl, was discovered by Scheele in 1779, who obtained it in the preparation of lead-

plaster, and named it "the sweet principle of oils." It is a colorless, viscid, neutral, uncrystallizable, inodorous fluid, of a sweet taste, is soluble in water and alcohol in all proportions, but is nearly insoluble in ether. Its specific gravity at 59° is, according to Miller and most authorities, 1.28, but Gorup-Besanaz makes it as high as 1.97. At 40° it becomes gummy and almost solid; at 212° it is slightly volatile; but if distilled alone, the greater part of it becomes decomposed; it may, however, be distilled without alteration in a current of superheated steam which has been raised to a temperature of between 500° and 600°. By this means, Mr. Wilson* has succeeded in separating heated fats into hydrated glycerine, and the acids with which it was previously in combination; the glycerine is thus obtained in a high state of concentration as a colorless, sirupy liquid, which can be thus prepared in unlimited quantity.

Glycerine forms soluble compounds with baryta, strontia, and lime; and it dissolves oxide of lead and numerous salts. Berthollet has found that glycerine, like Mannite (q.v.), is convertible into a true fermentable sugar, when digested with certain animal tissues.

Glycerine occurs ready formed in a few fats (as, for example, old palm-oil), and, according to Pasteur, is contained in all fermented liquors, and especially in wine, its quantity amounting to three per cent. of the fermented sugar. It is a product of the saponification of the various fats, although it does not exist as glycerine, but rather as a substance having the composition represented by the formula $C_6H_5O_3$. According to Berthollet's view, glycerine is a triatomic alcohol, and may be represented by the formula $C_6H_5O_3,3HO$; and in the animal and in many vegetable fats, the three atoms of water are replaced by three atoms of the anhydrous fatty acid. Thus—

$$\text{Stearine} = C_6H_5O_3 + \overbrace{3C_{36}H_{35}O_3}^{\text{Stearic Acid.}},$$

$$\text{Palmitine} = C_6H_5O_3 + \overbrace{3C_{32}H_{31}O_3}^{\text{Palmitic Acid.}},$$

$$\text{and Oleine} = C_6H_5O_3 + \overbrace{3C_{36}H_{33}O_3}^{\text{Oleic Acid.}}.$$

In the saponification of these fats—that is to say, when they are treated with potash, soda, or oxide of lead, or under the influence of heated steam—the fatty acid separates from $C_6H_5O_3$, which assimilates three atoms of water, and becomes glycerine.

We have already referred to the best mode (Wilson's process) of obtaining glycerine on a large scale; the usual method of obtaining it on a small scale is from olive oil, which we saponify by treating it with an equal weight of oxide of lead (litharge), which is mixed with water, and added to the oil, with which it is boiled till the saponification is complete. The glycerine is dissolved by the water, and is easily separated from the insoluble lead-plaster (a mixture of oleate and palmitate of lead). Any traces of lead are removed by sulphureted hydrogen, and the water is then expelled *in vacuo*, or over the water-bath. The former is preferable, as in the open air the glycerine becomes brown.

The uses of glycerine are numerous. In medicine, it is employed as a local application in diseases of the skin and of the ear; and it is used internally as a solvent for many drugs. It is a valuable preservative fluid for small and delicate anatomical preparations, and it has been applied to the preservation of meat. It has been added to the water in gas-meters, with the view of preventing it from freezing in winter, or from evaporating too rapidly in summer. It is used in the manufacture of copying-ink, and is of general application wherever a lubricating agent is required.

Many interesting researches have been carried on during the last few years regarding the true chemical nature and the artificial production of glycerine; they are, however, for the most part of a too purely chemical nature to be made intelligible to the general reader. We will merely remark that, like the alcohols in general, to which class glycerine is now assigned, it forms several classes or series of derivatives, the most important of which are its combinations with acids, forming *glycerides*, or compound ethers of glycerine, which are analogous in their composition to the various fats and oils. Berthollet has succeeded in forming these bodies synthetically, and has thus not only reproduced several of the natural fats, but has obtained a large class of similar bodies which were not previously known.

Treated with sulphuric acid, glycerine yields *sulphoglyceric acid* ($C_6H_8O_6,2SO_3$), and treated with phosphoric acid, it yields *phosphoglyceric acid* ($C_6H_8O_6.PO_5.HO$), a substance which occurs normally, in combination with soda and ammonia, in the brain and in the yolk of egg.

GLY'CINE, GLY'COCINE, GLY'COCOLL, or SUGAR OF GELATINE ($C_4H_5NO_4$), occurs in colorless, transparent, rhombic prisms, which have a sweet taste, and are devoid of odor. It is very soluble in water, the solution having no effect on vegetable colors, but is insoluble in alcohol and in ether. Glycine combines both with acids (as hydrochloric, nitric, sulphuric, and oxalic acid) and with metallic oxides, and the compounds in both cases are soluble and crystallizable; they are, however, of no great importance.

* The chemical superintendent at the works of Price's Patent Candle Company.

It is usually described as an animal base, but some chemists regard it as belonging to the class of bodies termed amido-acids, and as being amido-acetic acid; that is to say, acetic acid ($C_4H_4O_4$) in which one of the atoms of hydrogen is replaced by one atom of amidogen (NH_2). According to this view, its formula should be written $C_4H_3(NH_2)O_4$. Glycine is a product of various processes of decomposition of animal matters.

GLY'COGEN ($C_{12}H_{11}O_{11}HO$, according to the analysis of Pelouze) is a substance which in its properties seems intermediate between starch and dextrine. In contact with saliva, pancreatic juice, diastase, or with the blood or parenchyma of the liver, it is converted into glycose, and hence its name of glycogen. It occurs only in the cells of the liver, where it exists as an amorphous matter; but in the early stage of fetal life, before the liver begins to discharge its functions, instead of being found in that organ, it exists in special cells in the fetal structures known as the placenta and the amnion, and in the muscles, horny tissues, etc. In severe forms of disease, and especially in febrile affections, it seems to be temporarily absent from the liver. Its uses in the animal economy are noticed in the article LIVER.

GLYCOL is the type of a new class of artificial compounds, whose existence was inferred, and afterwards discovered, a few years ago, by Wurtz. In their chemical relation and properties, they form an intermediate series between the monobasic or monatomic alcohols, of which common alcohol is the type on the one hand, and the class of bodies of which ordinary glycerine is the type, on the other. The name of glycol, formed from the first syllable of glycerine and the last of alcohol, has been given to express this relation. According to the theory of types which is now commonly accepted (see TYPES, THEORY OF CHEMICAL), the glycols are termed diatomic alcohols, ordinary alcohol being a monatomic, and glycerine being a triatomic alcohol.

Ordinary glycol is formed from ethylene (C_4H_4), and hence it may be called ethyl-glycol, to distinguish it from propyl-glycol, which is formed from propylene (C_6H_6), from butyl-glycol, which is formed from butylene (C_8H_8), or from amyl-glycol, which is formed from amylene ($C_{10}H_{10}$).

Glycol is a colorless, slightly viscid fluid, with a sweet taste, and its composition is expressed by the formula $C_4H_6O_4$. For further information on this class of bodies, we must refer to any of the recent works on organic chemistry, or to a lecture on the *Histoire générale des Glycols*, delivered by Wurtz before the chemical society of Paris, and published in the *Leçons de Chimie professées en* 1860, par MM. Pausteur, Cahours, Wurtz, etc., 1861.

GLYCON, the maker of the colossal statue known as the Farnese Hercules, a figure of the hero leaning on his club. It was doubtless brought to Rome in the time of Caracalla, and was found a long time afterwards in his baths.

GLYCOS'MIS, a genus of plants of the natural order *aurantiaceæ*, trees, natives of the East Indies and the Mascarene Islands. The fruit of *G. citrifolia*, an East Indian species, is delicious.

GLYNN, a co. in s.e. Georgia, bordering on the ocean and bounded on the n.e. by the Altamaha river, intersected by the Brunswick and Albany, and the Mason and Brunswick railroads; 330 sq.m.; pop. '70, 5,376—3,450 colored. It is level, and much of the land consists of sandy barrens and swamps. The chief productions are sea island cotton and rice. Co. seat, Brunswick.

GLYPTODON (from the fluted character of its teeth), a gigantic fossil mammal, belonging to the order EDENTATA, and related to the *megatherium* and *mylodon*, also closely allied in form and structure to the modern as well as ancient armadillos. The first notice of this fossil animal was published by Cuvier, in 1823, in an extract of a letter addressed by the curé of Montevideo to M. August St. Hilaire, describing several huge fossil bones, and portions of tesselated bony armor. Cuvier supposed them to belong to the *megatherium*, remarking that that animal had pushed its analogies with the armadillo so far as to be covered like them with a scaly cuirass. The living families of *daspodidæ* and myrmecophagidæ of South America were represented in the same geographical area in pliocene and post-pliocene times by many interesting types, most of which, though representatives of those now living, differed from them in points of generic importance, while many were of comparatively gigantic proportions. The *glyptodon* differs from the *megatherium* in the number and form of its teeth, and from the armadillos in the form of the lower jaw, and in the presence of a long process descending from the zygoma; but in these respects it resembles the *megatherium*. Four species of *glyptodon* have been described by prof. Owen, the largest of which is *glyptodon clavipes*. The back and sides were covered by an armor or "carapace," of thick polygonal bony plates, which were dermal ossifications or scales, to the number of 2,000 or more. The head was also covered with a helmet of similar construction, and the tail was inclosed in a cylindrical casing of similar polygonal plates, which were, as a rule, nearly hexagonal. The carapace formed a massive dome for the support of which the skeleton was specially adapted. Thus, the last cervical and first two dorsal vertebræ are anchylosed to form a single bone, which articulates by a hinge joint with the next dorsal. The sacral and caudal vertebræ form a bony mass, and the illia are enormous. Unlike the living armadillos, the *glyptodon* has no movable bands in its armor, and therefore could

not, like them, roll itself up. The animal had no canines, but there were eight molars on each side of each jaw. The feet were massive, the ungual phalanges short, com pressed, and hoof-like, the fore feet being tetradactylous, and the hind feet with four or five toes. The carapace of the glyptodon in the royal college of surgeons in London has the following dimensions: length 5 ft. 7 in. following the curve of the back, in a straight line 4 ft. 8 in.; breadth over curve, 7 ft. 4 in.; in a straight line, 3 ft. 2 inches. The tail was 18 in. long, and 14 in. in circumference at the base. The dimensions of the glyptodon in the museum of natural history of Columbia college, New York, are as follows: entire horizontal length, from end of nose to tip of tail (of skeleton), 9 ft. 2 in.; length of carapace, following the curve, 6 ft. 9 in.; transverse of carapace, following the curve, 9 ft. 1 in.; horizontal breadth, from edge to edge of carapace (which is less than at the middle), 3 ft. 5 in.; length of head, 14 in.; depth of head from occiput to angle of lower jaw, 14 in.; circumference of tail at base, 4 ft. 5 in.; length of tail, 3 ft. 10 inches. The genus *schistopleuron* comprises gigantic armadillos, which were contemporaries of the *glypotodon*. *Schistopleuron typus* was 8 ft. in length, including the tail, and the carapace was 3 ft. in height. No *direct* representative of the glyptodon is known to exist at the present day, but the true armadillos, having movable bands in their armor, have been found in the post-tertiary accumulations of the plains of South America, and also of the cave deposits of Brazil. Some of them belong to well-known living types, as *dasypus*, *xenurus*, and *eutatus*, while others belong to extinct gigantic forms, as *chalamydotherium* and *pachytherium*, the former of these two attaining to the size of the existing rhinoceros. The ant-eaters also, *myrmecophagidæ*, are represented in the cave deposits of Brazil by the extinct *glossetherium*. See ARMADILLO, ANT-EATER, and MEGATHERIUM.

GLYPTOTHEK, a building in Munich, built 1816–30, having a famous collection of sculptures, brought there by king Louis I. They are Greek, Roman, and Egyptian, with some of modern work. There are twelve halls in the building, each containing a distinct epoch in art.

GMELIN, JOHANN FRIEDRICH, 1746–1804; nephew of Johann George; professor of natural history and botany at Tübingen, and professor of medicine at Göttingen. He was the editor of the 13th edition of Linnaeus's *Systema Naturæ*, and published works of his own on natural history.

GMELIN, JOHANN GEORG, 1709–55; son of the chemist of the same name. Having taken his degree in medicine, he repaired to St. Petersburg, where in 1731 he was appointed professor of chemistry and natural history. In 1733, by order of the empress Anna, he joined Deslisle, G. F. Muller, and Behring in an expedition for the exploration of Siberia, which country was penetrated as far as the Lena. He returned to St. Petersburg in 1743. In 1749, he was chosen professor of botany and chemistry at Tübingen, where he died. Linnæus named a genus of plants "Gmelina" in his honor.

GMELIN, LEOPOLD, a celebrated chemist, was b. at Göttingen, in Aug., 1788, and died at Heidelberg, in April, 1853. His father was professor of natural history and botany at Tübingen, and afterwards of chemistry at Göttingen; and for at least four generations members of the Gmelin family have distinguished themselves in chemistry and natural history. After taking his degree in medicine, he spent several years at Tübingen, Vienna, and Naples, in the study of chemistry and mineralogy; and in the autumn of 1813, he began his public career as a teacher of chemistry at Heidelberg, where, twelve months afterwards, he was appointed extraordinary professor of chemistry. He discharged the duties of his office with unremitting zeal until 1848, when he had an attack of paralysis; and in 1850, in consequence of a second attack, he was obliged to resign his professorial office. He published numerous contributions to chemistry and mineralogy in Schweigger's *Journal*, Poggendorff's *Annalen*, Liebig's *Annalen*, and in Leonhard's *Jahrbuch*, between the years 1815 and 1844. In 1820 he undertook, in conjunction with Tiedemann, a series of experiments on digestion; and in 1826 these philosophers published their celebrated work on this subject, under the title of *Die Verdauung nach Versuchen*, in two volumes. "But" (report of the council of the chemical society for 1854) "the greatest service which Gmelin rendered to science—a service in which he surpassed all his predecessors and all his contemporaries—consists in this: that he collected and arranged in order all the facts that have been discovered in connection with chemistry. His *Handbuch der Chemie* stands alone. Other writers on chemistry have indeed arranged large quantities of materials in systematic order, but for completeness and fidelity of collation, and consecutiveness of arrangement, Gmelin's *Handbook* is unrivaled." The first edition of this great work appeared in 1817-19, and included, in two vols. of moderate size, the whole extent of chemical knowledge as it then existed. The fourth and last appeared between the years 1843 and 1855, and extended to six vols., the last volume being edited, after Gmelin's death, by Schlossberger and List. An English translation of this edition (under the auspices of the Cavendish society), with important additions by Mr. Watts, the translator, was published in 1861.

GMELIN, SAMUEL GOTTLIEB, 1743–74, an eminent naturalist, nephew of J. G. Gmelin, was b. at Tübingen. He graduated there in 1763, went to St. Petersburg in 1767, and in 1768, with Pallas, Güldenstadt, and Lapuchin, commenced a journey for

the scientific exploration of the s.e. possessions of Russia. Having visited in succession the western districts of the Don, the Persian provinces, to the s. and s.w. of the Caspian sea, the regions of the Volga, and the e. borders of the Caspian, he, in 1774, was on his way back to St. Petersburg, when he was seized as a hostage by Usmey Kahn, of the Kaitak tribe, through whose ill treatment he died.

GMELI'NA, a genus of trees of the natural order *verbenaceæ*, having a small 4 to 5-toothed calyx, and a large, obliquely bell-shaped corolla. *G. arborea*, called GOOMBAR, or KOOMBAR, in India, is the most valuable for its timber. The tree attains a great size, and is widely diffused, both in Hindustan and the eastern peninsula. It has heart-shaped leaves and panicled flowers. The wood resembles teak, but is closer in grain, and lighter. It bears exposure to water better than most kinds of timber. It is used for many purposes, as for foundations of buildings, decks of boats, Venetian blinds, picture-frames, etc.

GMÜND, a t. of Würtemberg, in the circle of Jaxt, stands in a beautiful and highly cultivated district on the Rems, 29 m. e.n.e. from Stuttgart. Gmünd has important manufactures of *bijouterie* and hardware, and carries on spinning and stocking-weaving. Hops are produced in the neighborhood in great quantity. Gmünd was formerly an imperial free city, and in the middle ages had a pop. of 18,000. It was added to the kingdom of Würtemberg in 1803. Pop. '75, 12,838.

GMUN'DEN, a t. of the Austrian empire, in upper Austria, 32 m. s.w. from Linz. It is situated at the lower extremity of the Traunsee or Gmundensee, the lake of Traun or Gmunden, where the river Traun issues from it, in the midst of scenery at once extremely grand and beautiful. Gmunden is a well-built town. It is connected by a branch-line with the railway between Linz and Salzburg. The salt-mines of the vicinity give occupation to many of the inhabitants, and the town is a chief station of the salt-trade. Steamboats ply upon the lake. Pop. '69, 6,062.

GNAPHA'LIUM. See CUDWEED.

GNAT, *Culex*, a genus of dipterous insects, having the wings laid flat on the back when at rest; the antennæ thread-like, 14-jointed, feathery in the male, and hairy in the female; the mouth furnished with a long projecting proboscis, adapted for piercing the skin of animals and sucking their blood. They are said to feed also on vegetable juices. The species are numerous, and abound in almost all parts of the world, particularly in marshy regions; and some of them, under the name of mosquitoes (q.v.), are known in many countries as most annoying pests. An irritating fluid, injected through the proboscis, makes their punctures painful, and causes swelling. The proboscis of a gnat is an extremely interesting microscopical object. It is a membranous cylindrical tube, clothed with minute, feather-like scales, and terminated by two lips, which, when closed, form a kind of knob, and by six sharp bristles or very small lancets. The female gnats have the most powerful proboscis, and are the principal blood-suckers. Some persons are much more liable to the assaults of gnats than others. The flight of gnats is very swift, and the extremely rapid vibration of their wings causes the loud and sharp buzzing sound, which so often prevents sleep when even one of these insects has found its way into a bedroom on a summer night. The eggs of gnats are deposited on the surface of shallow stagnant water, placed side by side, united by an unctuous matter, and fastened to the bottom by a thread, which prevents their floating away. They are soon hatched; indeed, a single summer sees several generations of gnats. The larvæ are to be seen in immense numbers in stagnant waters; they are of an elongated worm-like form; are destitute of feet, but swim and dive by means of fin-like organs; they feed on insects, and also on vegetable substances; and often suspend themselves at the surface of the water, head downwards, for the purpose of respiration, by means of radiating bristles attached to a long spiracle or tube at the caudal extremity of the body, by which air is admitted to the *tracheæ* or air-tubes. The pupæ also inhabit water, and are active; they remain almost constantly at the surface of the water, with the body recurved; and the respiratory openings of the air-tubes are now in the thorax.—The COMMON GNAT (*C. pipiens*) is of very wide geographic distribution. It is about three lines in length, brown, with whitish rings on the abdomen, the wings unspotted. It so abounds in some of the fenny parts of England, that beds are occasionally surrounded with gauze curtains, as in India on account of mosquitoes.—A number of genera, allied to *culex*, are united by many entomologists into a family called *culicidæ*.

GNEISENAU, AUGUST, GRAF NEIDHARDT VON, a distinguished Prussian general, was b. at Schilda, in Prussian Saxony, in 1760. After serving in the Austrian army he accompanied the German auxiliaries of England to America. On his return he joined the Prussian army and gave proof of his military genius in his defense of Colbert. But his most distinguished service was his share in the Waterloo campaign, in which he was Blücher's chief of the staff, and principally directed the strategy of the Prussian army. He was made field-marshal in 1831, the year in which he died.

GNEISS, a term introduced from the German, as the name for a variety of metamorphic rock, which has the same component materials as granite, and differs from it only in these materials being arranged in layers, rather than in an apparently confused aggregated mass. The minerals of which it is composed are quartz, feldspar, and mica. The

mica is sometimes replaced by hornblende, producing a gneiss corresponding to the variety of granite called syenite. The different ingredients occur in various proportions, altering the character and appearance of the gneiss accordingly. It is often difficult to determine hand specimens of gneiss; for, on the one hand, they are sometimes so crystalline that they resemble granite, while, on the other, the schistose varieties approach so near to mica-schist, that even in the field, under the most favorable circumstances, it is not easy positively to separate them.

Gneiss was originally deposited as sand or mud, and has been converted into a hard, tough crystalline rock by long and continuous subjection to metamorphic action, induced, perhaps, chiefly by heat. It has generally been considered as an azoic rock, that is deposited before the existence of life on the globe. The older strata, classified by Logan under the title Laurentian, the equivalents of which have been recently observed by Murchison in Scotland, have as yet proved destitute of fossils, but this may be owing to the extreme metamorphism they have undergone. The Cambrian and Silurian strata of the n. of Scotland have also been to a large extent converted into gneissose rocks, which contain intercalated with them fossiliferous limestones. It would seem, indeed, that gneiss and its allied stratified rocks are not necessarily "primary rocks," but may occur wherever an agency sufficiently powerful has acted upon ordinary sandstone and shale.

GNE'SEN, a small t. of Prussia, is situated in a district abounding in hills and lakes, in the province of Posen, and 30 m. e.n.e. of the town of that name. It was the earliest capital, and is said to be the oldest town of Poland. Pop. '75, 11,206.

GNETA'CEÆ. See SEA GRAPE.

GNOME (Gr. *gnome*), a pithy and sententious saying, commonly in verse, embodying some moral sentiment or precept. The gnome belongs to the same generic class with the proverb; but it differs from a proverb in wanting that common and popular acceptance which stamps the proverb, as it were, with public authority. The use of gnomes prevailed among all the early nations, especially the Orientals; and the literatures, both sacred and profane, of most countries abound with them. In the Bible, the book of Proverbs, part of Ecclesiastes, and still more the apocryphal book of Ecclesiasticus, present, so far as regards language and structure, numberless illustrations of the highest form of this composition. The other books of the Old Testament contain many examples; and in the New Testament the familiar lessons of our Lord are frequently presented in this striking form, which was peculiarly adapted to impress and move the classes whom he addressed. The Indian, the Arabian, and the Persian literatures also are rich in gnomes, as are those of the northern nations. But the most interesting form which they have taken is that in which we find them in Greek literature, in which the writers who have cultivated this form of composition are known as a distinct class—the gnomic poets (*gnomikoi*). The Greek gnome is commonly couched in the elegiac distich; and the most celebrated gnomic poets were Solon, Theognis, Phocylides, Simonides, Tyrtæus, and Xenophanes of Colophon. The most remarkable of these is Theognis, whose gnomes extend to above 1200 lines. The remains of gnomic writers have been repeatedly edited under the title of *Gnomici Poetæ Græci* from the days of Melancthon downwards. The standard editions are those of Bekker (1815) and Welcker (1826). There is, moreover, a popular edition by Brunck, which is reprinted in the Tauchnitz classics; and the gnomic poets are also commonly included in the collections of minor Greek poets.

In Latin literature, the *Disticha* of Dionysius Cato, the authorship of which has proved so fertile a source of controversy, may be mentioned as belonging to the class of gnomes.

GNOME, the name given in the cabalistic and mediæval mythology to one of the classes of imaginary beings which are supposed to be the presiding spirits in the mysterious operations of nature in the mineral and vegetable world. They have their dwelling within the earth, where they preside specially over its treasures, and are of both sexes, male and female. The former are often represented in the form of misshapen dwarfs, of whom the well-known "Rübezahl," or "Number-nip," of German legend is a familiar example. Pope, in the *Rape of the Lock*, and Darwin, in the *Loves of the Plants*, have drawn upon the more pleasing associations of this curious branch of mythology. See ELEMENTAL SPIRITS.

GNO'MON. When a rectangle is divided into four parts by cross lines parallel to its sides, the sum of any three of the parts is called the *gnomon*. See Euclid, b. ii. prop. 5, and seq.—Gnomon has also a meaning in dialing (q.v.).

GNOMO'NIC PROJECTION. See PROJECTIONS.

GNOS'TICS (from Gr. *Gnōsis*, knowledge), the collective term for a number of early Christian sects which were known besides—with one insignificant exception—by special names derived from their respective founders. The word gnosis, when first applied to revealed religion, in many passages both of the Septuagint (for the Hebr. *Déah*) and the New Testament, expressed a full and comprehensive acquaintance with, and insight into, the received laws and tenets, ritual and ethical, and was consequently praised as a desirable acquirement; by St. Paul even called a special gift (*Charisma*) (1 Cor. xii. 8,

etc.). Gradually, however, there was—first by the Judæo-Alexandrine schools—ingrafted upon it a meaning more akin to that in which it was occasionally used by Pythagoras and Plato; it designated a knowledge of certain mysteries, which lay hidden beneath the letter of the religious records, and could be received only by a few superior minds, while the multitude had to be satisfied with the outward apparent meaning. The remarkable form of Christianity to which the word in this sense was applied, is a religious phenomenon as extraordinary as were the times and causes that gave it birth. Rome had conquered well-nigh the whole of the then known civilized world, and within her vast dominions the barriers, which had hitherto separated the multifarious nations of east and west, were broken down. From the remotest corners of the empire philosophers and priests, scholars and teachers, flocked to Rome, to Athens, to Alexandria, and communicated to each other, discussed, and frequently amalgamated their widely differing creeds and systems to such a degree that the former national or personal individuality of opinion was almost effaced, making room either for a vacillating indecision, or at the best a shadowy and passive eclecticism. And while, on the one hand, Greek philosophy, which formed a principal part of the education of the higher classes, had become almost exclusively a Platonism, sliding into overt skepticism; on the other hand, the naturalization in the Roman empire of a promiscuous Pantheon, whose gods were gathered from Egypt, Greece, Persia, India, and countries still more remote, had at length produced, out of an unparalleled mixture of religious ideas and fancies, a superstition so abject and unnatural, that it too, at last, was ready to give place to despairing unbelief. Judaism, again, had outlived its political existence, and began to assert itself as a faith, independent of any state or dominion of its own, divided, however, into different schools, according to the more or less strict adherence to the letter of its written and oral laws. Nay, the influence of Hellenism had, among the Alexandrines, produced such effect that, of the living body of Judaism, little remained but a skeleton framework, round which allegory and symbol had woven their fantastic fabric. Christianity, as yet not clearly defined, swept all the more irresistibly over the regions from the Euphrates to the Ganges, the Nile to the Tiber, as it offered a code of morals sublime and yet simple, a faith human and withal divine, superior to any of the abstruse and exploded Polytheisms, to a world agitated to its lowest depths, and yearning for some new and more satisfying doctrine; while, at the same time, it denounced the stringent and severe ritual tenets of its mother-religion, Judaism, as inconsistent with the freedom of the human mind. Yet it was not to be expected that the old pagan creeds and the old philosophies would expire without a struggle. They made a last stand, and produced in their and the ancient world's dying hour Gnosticism. It sprang suddenly out of a monstrous chaos, a consummate religiousl ececticism, bold, consistent, to a certain degree even sublime. The wildly opposite ideas of Polytheism, Pantheism, Monotheism, the most recondite philosophical systems of Aristotle, Plato, Pythagoras, Heraclitus, Empedocles, etc., together with the awe-striking Mysticism and Demonology which after the Babylonian captivity had created, in the very heart of Judaism, that stupendous and pre-eminently anti-Jewish science of Cabbala (q.v.)—all, it would appear, had waited to add something of their own to the new faith, which could not hold its own under all these strange influences. An open attack was no longer of any use; so, assuming the garb of the enemy, they sought to carry destruction into the center of the hostile camp. Moreover, an aristocracy of mind, powerful and numerous as none had ever been before, could not but, even when it had outwardly assumed the new religion, loathe the thought of sharing it completely and unreservedly with the herd of freed and unfreed slaves around them, with the low and the poor in spirit; and the exclusiveness of Gnosticism was undoubtedly, next to the fascination of its dogmas, one of the chief reasons of its extraordinarily rapid propagation.

We have stated at the outset that Gnosticism was but a general name for a great number of diverging Christian schools. But all these had some fundamental points in common, which we will attempt to specify briefly, as far as the fragmentary and adulterated nature of the evidence will permit; for unluckily all we know of the Gnostics, we know from their Jewish and Christian adversaries, who confessedly took especial pride in representing them and their belief in their darkest hues.

There is a Divine Being, whose essence is love, grace, and mercy. He is enthroned in the highest height, inclosed in an abyss (*buthos*). He is the sum of being, he is silence, abstraction, incomprehensible, for human minds almost non-existing (*ouk on*). The Mosaic cosmogony has not seemingly, they said, brought us one step nearer to the solution of the problem of the creation. Out of nothing, nothing can come, notwithstanding a divine fiat; for God can, through his spiritual nature, have no connection whatever with corporeal things, and he could not have originally *made* them. They, therefore, assumed a pre-existing *matter* (*hyle*), out of which the universe was merely *formed*. A corroboration for this opinion was found—according to the peculiar Gnostic mode of interpretation—in the two adjectives *tohu vabohu* (without form and void) (Gen. i. 2), applied to the earth, and which were by them interpreted as substantives (*kenoma kenon*) intended to express the original substance of the universe (Cf. Gen. Rab. i.). Between this hyle, or visible world, however, which was either represented as the darkness or shadow alongside the divine light, as a sluggish, stagnant mass, or as a turbulent, active kingdom of evil; and that supreme incomprehensible Being, whose

goodness could have nothing to do with the evils of the world, no more than his perfection with its defects and misery, there existed a *plerōma*, or fullness of light. In this fullness dwelt embodied attributes of divinity, the abstract ideas of wisdom, justice, right, power, truth, peace, and many more which had emanated or flowed out (in pairs, as some held, male and female) from the supreme central point, as rays innumerable flow out of the sun, as countless numbers from one unit, as echoes from a sound, or as, primarily, all the founts and rivers arise from the waters below. At the head of these emanations or Æons (Everlasting ones—like their source) which, descending lower and lower, form a link between heaven and earth, stands the Nous; and one of the lowest Æons is the *Demiurgos*. He is the real framer and master of the visible world, and partakes to a certain degree of its nature. On the nature of this Demiurgos (*Jaldabaoth, Archon*), however, the two principal divisions of Gnosticism, which might be termed Judæo-Alexandrine and Syrian respectively, widely differed. The former took him as the representative and organ of the highest God. It was he who had been put by the divine will over Israel, especially, under the name of Jehovah. As other, though inferior, angels presided over the destinies of other nations, so this higher Æon had to protect the peculiar people of God. It was he, therefore, who revealed himself—he who gave the laws—he who had sent the prophets. But in all this he acted rather as an unconscious medium; he was no more able to comprehend the full meaning of the ideas revealed through him in the Old Testament, than he understood the scope and significance of the creation. His principal attributes are justice and severity, which, carried out with stern consistency, become cruelty. These Gnostics distinguished also among the Jews themselves, those "after the flesh" who, confounding the likeness with the original, the symbol with the idea, took the Demiurgos to be the supreme God, and those "after the Spirit," or Israelites indeed—the privileged few who, divining at least the veiled ideas of the supreme God, needed no such education by fear or hope, punishment or reward, at the hands of the Demiurgos, but rose above him in understanding and conception of things human and divine. The other principal party of the Gnostics, however, the Syrian, under the influence of the Parsic (Zoroastrian) dualism, so far from considering the Demiurgos as an instrument of divinity, willing but poor in intellect, looked upon him rather as a rival, and consequently conflicting power. He is the primary evil opposed to the primary good. The divine germs which, according to both parties, had been communicated through the lowest emanations in their downward course to matter and to mankind, the Demiurgos of the Alexandrians had not known how to develop in a proper manner, but had weakened, sometimes neutralized them from want of knowledge, thus engendering all earthly sin and misery *against* his will, while the Syrian Demiurge spitefully and maliciously stifled these germs in order to wrest the power over the world from the Divine Being altogether. His base, revengeful, and withal limited nature, they said, is fully and clearly stamped upon the Old Testament—exclusively his work.

Man—in this all the schools were agreed—was divided into three classes, corresponding more or less to these predominant powers of the world: Divinity, Matter, and Demiurgos. There were first the spiritual men or *Pneumatikoi*, inspired by the highest God, striving towards him, with him; initiated into his counsels, understanding his essence. They were free from the yoke of law, for terrestrial nature had no power over them; they were the prophets, guiding, but not guided; the possessors of the true Gnosis. Diametrically opposed to these, as was hyle to divinity, are the terrestrial men, *Sarkikoi* or *Choiks*—of the earth earthy—who are tied and bound by matter; they can neither aspire to the height of spiritual men, nor are they to be ruled by the precepts of law. Between these stand the *Psychikoi*, the blind servants of the lawgiving Demiurgos, who are, through the restraints put upon them by his either stupid or spiteful precepts, free to a certain degree from the terrestrial powers, but they can never reach the height in which the pneumatics habitually dwell. And again, corresponding to these three classes of men, there were three principal religions; Christianity above, heathenism below, Judaism in the intermediate space.

The two leading tendencies of Gnosticism, of which we have spoken, also manifested themselves, accordingly, in the view they each took of the person of Christ himself. According to both, he was the highest Æon, suddenly sent down by the Supreme Being, to rescue and reclaim certain higher natures—for the lowest stratum of men, the carnal or terrestrial, was irredeemably lost—which had either been led astray by the Demiurgos, or had become entangled in the net of matter. At the same time the harmonious combination of the human and divine in Christ, which the New Testament assumed, stood in direct opposition to the very basis of Gnosticism. The visible and the invisible, the finite and the infinite, God and man, cannot combine; in this they all agreed. But while Judaizing schools, divided Christ into two direct persons, one of heaven and one of earth, who had only become one at the baptism in the Jordan, and who had separated at the crucifixion; the other oriental section of Gnostics held that Christ's earthly manifestation in the flesh, that his whole humanity, was a mere shadow or delusion.

It might well be asked how, with this extraordinary conglomeration of monotheism, pantheism, spiritualism, and materialism, the Gnostics could possibly take their stand on the Bible, which, from first to last, it would seem, denounces, and in the strongest

manner, doctrines such as the foregoing. The only answer to this is, that they, and they only, were the Pneumatikoi—the initiated. It was well for the other portions of mankind, the natural men, to take everything, including Scripture, and its historical as well as its dogmatical parts, literally. As in creation, so in the book; the Gnostics, guided by their inner lights, saw beneath the surface, and saw everywhere, the most complete affirmation of their peculiar ideas. If the Midrash (q.v.) gave the most fanciful and allegorical interpretations of the Old Testament, for the sake of inculcating moral principles, for edifying, elevating, comforting the congregation, but without the faintest pretense that any but the fixed traditional interpretation was binding and authoritative —Gnosticism, with a proud contempt of the laws of language and thought, did the same for its own purposes, but made its wildly symbolical and erratic interpretations of the religious records binding. We are far from saying that they were in all cases guilty of intentional deception, in the ordinary sense of the word; although they must frequently have known the real meaning to be totally opposed to their explanations, as most of their teachers were learned Jews; but they, like other enthusiasts, gradually lost the power of discriminating between that which was, and that which might be. Some, however, more consistent, assumed that Christ and his apostles had still been partially under the influence of the Demiurgos, and also that what they had taught, they had expressed in accordance with the blindness of those whom they addressed. Proceeding consistently, they by degrees excluded from the code most of the books of the New Testament, especially those in which there were distinct attacks against themselves; and substituted a number of other epistles and religious documents of their own, in Greek and Syriac, such as the *Prophecies of Cain*, *Writings of Pachur*, *Psalms* by Valentinus and Bardesanes, *Gnostic Hymns* by Marcos, *Books of Adam*, *Enoch*, *Moseh*, *Eliah*, *Isajah*, etc., not to mention a host of writings by newly invented prophets of such peculiar names as Pachor, Barkor, Armagil, Barbelon, Balsamum, Lensiboras, etc. (Hier. ad Theod. iii. 6, etc.).

Practically Gnosticism influenced the lives of its adherents in two totally distinct ways: according to the view they took of the nature and office of the Hyle and Demiurgos. The Hellenizing Gnostics, striving to free themselves as much as in them lay for their stupid and degrading bonds, become ascetics, austere, rigid, and uncompromising. The oriental view, however, of the dualistic and antagonistic powers of light and darkness, good and evil, which was adopted by the other portion of the Gnostics, led them, on the other hand, to the practice of the grossest sensuality, in token, they said, of their utter contempt for matter, and still more for the Demiurgos—body, and its enjoyments; everything terrestrial, in short, had as little to do with their mind, which was one with the Supreme Deity, as had matter with God. Transgression there was none, because there was no law; there could be no law for them who were better even than the angels—who were subject to none; a distortion of a dictum in the *midrash*, that "the law was not given to angels, but to mortal men," and was therefore to be administered leniently. They, indeed, knew not how to express to the full their utter contempt for this Jewish Jehovah, or Demiurgos. There were others among them who called themselves after the serpent (*ophites*), which by tempting Eve brought into the world the blessing of knowledge, and had thus became its greatest benefactor. Others took the name of *Cainites* (*Balamites*), contending that Cain had been the primeval representative of Gnosis, as opposed to the *Pistis*, or blind unreasoning faith of Abel, the representative of the *Psychikoi* (the Jews)—Seth being the type of the *Pneumatikoi*. Another class, of similar tendencies, styled themselves simply *antitacts*, (opponents to the law), a name indicative of their readiness to take under their especial protection, not only all those persons condemned in the Biblical records, but all the offenses prohibited in them.

It is as hopeless a task to follow the development of this metaphysical and unique abnormity called Gnosticism, of which we have attempted here to give a faint outline, through the bewildering maze of its ramifications from its beginning in history to its final disappearance, as it would be to fully trace its component parts to their original sources. It sprang up in the first c., it had spread over the whole civilized world in the second, and it was fiercely and unremittingly combated from the second to the sixth c. by Judaism, Platonism, Neo-Platonism, and, above all, by Christianity. With respect to the relation of the Gnostics to the orthodox church, however, we must observe that they all the while feigned a naïve surprise at not being fully recognized as most faithful followers of Christianity, and members of the large Christian body. All they aspired to, they said, was to be allowed to form a small central circle within the large outer circle, to be a kind of theosophic community, consisting of the more advanced members of the church; indeed, they not only adhered, for the most part, to the outward forms of Christian worship, but occasionally even surpassed it in pomp and splendor. And such was the fascination Gnosticism exercised over the minds, that, had it not been for the innumerable schisms in its own camp, which prevented its alliance with the political power of the day, it would have stood its ground much longer. On its influence upon the Judaism of its time, as it is recognizable in many passages of contemporaneous Jewish literature; on its lasting influence upon Christianity; and on its frequent revivals in the middle and modern centuries, we can as little dwell here as on its embodiment in many philosophical systems, ancient and modern.

We can only take, in conclusion, a cursory glance over some of its principal schools, in giving a brief list of their founders (of whom, and their chief doctrines, special notices will be found), and the places where they flourished, without attempting to divide them minutely, as has been done in different ways, by Neander, Gieseler, Matter, Baur, Schaff, into Judaizing and Christianizing; speculative, practical, and antinomian; dualistic and emanationistic; or to classify them strictly by origin and locality. Suffice it to mention, that among the precursors of Gnosticism are recorded some half-mythical personages, such as Euphrates, mentioned cursorily by Origen; Simon Magus, whose history, as given in the Acts, has been made the groundwork of innumerable legends; Menander, his successor; Cerinthus, the apostle of the Millennium; and Nicolaus, the father of the pre-eminently immoral sect of the Nicolaitans. Founders of special schools were, in Syria, Saturninus of Antioch, about 125 A.D. under Hadrian; Bardesanes of Edessa, 161 A.D., the author of many hymns, and who looked upon the Holy Ghost as at once wife and sister of Christ; Harmodius and Marinus, his disciples; Tatian of Rome, the founder of the *Encratites*, who wrote a still extant *Oration to the Greeks*. Of Egyptian founders of Gnostic schools we may mention Basilides of Alexandria (125–140), who assumed 365 æons or circles of creation, two Demiurgi, and a threefold Christ, and whose mystic use of numbers and names reminds us most strikingly of the Cabalistic *Geometria;* his no less famous son and follower, Isidorus, the author of a system of ethics; and Valentinus of Rome, who died 160 A.D. at Cyprus, a Jew—as indeed was Markos his disciple, and, very likely, Basilides and Jaherninus. Of Valentin's successors who founded schools of their own, are mentioned besides Markos, Secundus, Ptolemy, Colarbasus, Heracleon, Theodorus, and Alexander. To the Syrians may also be reckoned the Ophites, Cainites, and Sethites (see above). In Asia Minor, we have Marcion about the middle of the second c., who is rather remarkable for his consistency in scornfully rejecting the whole of the Old Testament and all apostolic authority save Paul. His school flourished up to a very late period. Among non-localized Gnostics may be enumerated the schools of Carpocrates and Epiphanes, the Bortonians, Antitacts (see above), Phibionites, Archontics, and a great many others.

Irenæus, *Adv. Haer.;* Tertullian, *De Præscript. Hæret.* and *Contra Gn. Scorpiacum;* Epiphanius, *Adv. Hæres.;* Theodoret, *Hæret. Fabb.;* Plotinus (*Ennead.* ii. 9); Mosheim, *De Rebus Christ. ante Const. comm.;* Münter, *Vers. über die Kirchl. Alterth. d. Gn.;* Lewald, *De Doctrina Gnostica* (Heidelb. 1818); Neander, *Genet. Entw. d. Gnost. Syst.* (Berl. 1818); Möhler, *Urspr. d. Gn.* (Tübingen, 1831); Matter, *Hist. Crit. du G.* (Par. 1843–44, 2d edit. 3 vols); Baur, *Die Chr. G.*, etc. (Tübingen, 1835). See also Neander's and Gieseler's *Histories of the Church;* Dorner's *Christology;* Bunsen's *Hippolytus and his Age*, and Grätz, *Gnosticismus und Judenthum*, besides many of the histories of philosophy and of Christian dogma.

GNU, *catoblepas*, a genus of ruminant quadrupeds, which naturalists generally rank with the antelope family (*antilopidæ*), but which some place in the ox family (*bovidæ*), and of which the best-known species has been often described as apparently made up of parts of different animals, not only of the antelope and the ox or buffalo, but even of the horse. This species (*C. gnu* or *antilope gnu*) is a native of south Africa; it has disappeared from the more settled parts of Cape Colony, but is to be seen in herds on the arid plains beyond these boundaries in company with the zebra or the quagga, and with flocks of ostriches. The form and action of gnus so much resemble those of zebras and quaggas, that at a distance they may be readily mistaken for them. The size of the gnu is that of a large ass; the general color is yellowish tawny. Both sexes have horns. The limbs are slender, like those of deer and antelopes. The gnu gallops with great speed. It has been usually represented as a very fierce animal, and certainly shows much ability to defend itself with its horns, when unable to escape from danger by flight; but when taken young, it is easily tamed, and readily associates with oxen, accompanying them to and from the field. There are two or three species, all south African, nearly resembling the common gnu, and one of them at least is very considerably larger. Their flesh is said to be palatable.

GÓA, a city of Hindustan, on the Malabar coast, in lat. 15° 30′ n. and long. 74° e., while the dependent territory of the same name stretches in n. lat. from 14° 54′ to 15° 45′, and in e. long. from 73° 45′ to 74° 26′, containing 1066 sq.m., and 420,000 inhabitants. Góa was once the capital of the Portuguese dominions in India, but is now in a state of hopeless decay. It was valuable chiefly on account of its harbor, one of the best on the w. coast of Hindustan, from which it was about 5 m. distant; but having the misfortune to be ravaged by the cholera in the beginning of the 18th c., most of the Portuguese left it, and settled nearer the sea, at Panjim or New Góa, which is the present seat of government, with a population of about 24,000. The inhabitants of the old city are almost entirely ecclesiastics, the place being the see of an archbishop, the primate of the Portuguese Indies. Góa was conquered by Albuquerque in 1508, at which time it was inhabited by an Arabic people.

GOALBA'RA, a district of British India, in the chief-commissionership of Assam (though not recognized as part of Assam till 1874), stretches in n. lat. from 25° 40′, to 26° 31′, and in e. long. from 89° 42′ to 91° 8′, containing 4,433 sq.m., and (1872) 444,761

inhabitants. On the n. it is bounded by the native state of Bhotan. Its capital, of its own name, stands on the river Brahmaputra, in lat. 26° 8′ n., and long. 90° 40′ east.

GOA POWDER (also called *Araroba*, *crysarobin*, *pondu dr Goa*), a drug imported in the form of a yellowish powder, which on exposure to the air becomes darker, and which has been brought into notice by Dr. Fayrer, of Calcutta, and others, as a remedy for ring-worm. It derives its name from the Portuguese colony of Goa, where it appears to have been introduced about the year 1852. In 1875, it was shown by Dr. Lima that the substance had been exported from Bahia to Portugal, where it found its way to the Portuguese colonies in Africa and Asia. The tree which yields it belongs to the genus *Andria*, of the natural order *Leguminosæ*, and has been named *A. Araroba*. It is met with in great abundance in certain forests in the province of Bahia, preferring low and humid spots. The tree is from 80 to 100 ft. high, and is furnished with imparippinate leaves, the leaflets of which are oblong, about 1¼ in. long, and ⅝ in. broad, and somewhat truncate at the apex. The flowers are papilionaceous, of purple color, and arranged in panicles. The Goa powder, or araroba, is contained in the trunk, filling crevices in the heartwood. To obtain it, the oldest trees are selected as containing the larger quantity, and after being cut down are sawn transversely into logs, which are then split longitudinally, and the araroba chipped or scraped off with the axe. During this process the workmen feel a bitter taste in the mouth; and great care has to be taken to prevent injury from the irritating action of the powder on the eyes. In this state, i.e., mixed with fragments of wood, the Goa powder is exported. It is used in the form of an ointment made by rubbing together 40 grains of the powder, 10 drops of acetic acid, and an ounce of lard. This is smeared over the eruption once a day for several days. A tincture is sometimes used, applied with a brush, and over this a little lard may be rubbed. It is probable, however, that a properly diluted solution of carbolic acid, a remedy which has been used in conjunction with araroba, or Goa powder, is a more effective and agreeable remedy.

GOAT, *Capra*, a genus of ruminant quadrupeds of the family *capridæ* (q.v.), so closely allied to the sheep that it is not easy exactly to define the distinction, although the common domestic goat and sheep are of widely different appearance. One of the most marked of the distinguishing characters is, that the horns of goats are directed upwards, backwards, and outwards, whilst those of sheep are more or less spirally twisted. Another character is the beard on the chin of the male goats, which is wanting in the sheep; but these characters are not perfectly constant. Perhaps a more constant character is the straight line of the face in goats, as compared with the arched line in sheep. The tail of goats is also much shorter than that of sheep. A curious but constant mark of distinction is the want of a small pit, producing a fatty secretion between the toes, in goats, which exists in sheep, and is peculiar to them. And another constant mark is the strong smell of male goats, particularly during the rutting season, which is wanting in sheep. Equally constant are the differences of temper and manners, goats being in a high degree curious and confident, and the very term *capricious* referring to their exhibition of the quality which it denotes. In both goats and sheep, both sexes are usually furnished with horns, the want of which is a variation apparently caused by domestication, and is most frequent in females. The horns and beard of female goats are always smaller than those of the male. Some goats have horns 8 ft. long.

Goats are found wild only in mountainous countries; they all exhibit a great aptitude for scrambling among rocks and bushes, are extremely sure-footed on narrow ledges and pinnacles, and display great strength and agility in leaping. They also prefer as food the leaves and small branches of shrubs, and the strongly aromatic herbs which abound in mountainous situations to the herbage of the richest pastures. The Greeks and Romans sacrificed the goat to Bacchus as an enemy of the vine. It is difficult in this genus to determine what are species and what are varieties. The COMMON or DOMESTIC GOAT (*C. hircus*) has existed as a domestic animal from the earliest ages; it is frequently mentioned in the books of Moses, and formed a large portion of the flocks of the patriarchs. It adapts itself to almost all climates, and thrives under the care of man in the hottest parts of India and Africa, and with the protection only of a shed from the severity of winter, in the northern districts of Scandinavia. Amidst such diversity of circumstances, considerable diversity of breeds might be expected, and accordingly, besides the variety common in Britain, there are the Syrian goat, the Angora (q.v.) goat, the Cashmere (q.v.) goat, all remarkable for the greater length and fineness of their hair; a beautiful dwarf variety from west Africa called the Guinea goat, and many others. Some of these, as the Syrian goat, have large pendant ears. In nothing does variation seem more readily to result from the influence of climate and other circumstances, than in the quantity and quality of the hair, and in the relative abundance of the two kinds of it, both of which are well exhibited in the common goat, the long soft hair, and the softer woolly hair beneath it. But in many other respects, also, the domestic goat is subject to variation, more than perhaps any other domestic quadruped except the dog.

Goats can be kept with advantage in situations too rocky, or where the herbage is too scanty for oxen or sheep. They were formerly kept in greater numbers in Britain than they now are. On some of the mountains of Wales and of Scotland, the goat is almost

as completely wild as if it were indigenous, and even to get within shot of it is difficult. It is capable, however, of the most perfect domestication, and becomes extremely attached and familiar. It is apt, indeed, to prove a troublesome pet, and makes use of its horns, although not angrily, much more freely than is at all agreeable.

The uses of the goat are numerous. The flesh is good; that of the kid, or young goat, is in most countries esteemed a delicacy. The milk is very rich and nutritious, more easy of digestion than that of the cow, and is often useful to consumptive patients. Some goats yield as much as four quarts of milk daily, although the average quantity is more nearly two. Both cheese and butter are made of goats' milk; they have a peculiar but not disagreeable flavor. Goats' milk is still very much used in Syria and other parts of the east, as it was in the days of the patriarchs. The skin of the goat was early used for clothing, and is now dressed as leather for many uses, particularly for making gloves and the finer kinds of shoes. The hair which may be advantageously clipped annually, is used for making ropes which are indestructible in water, and for making wigs for judges, barristers, and ecclesiastical dignitaries. For the latter purpose the hair of white goats is used. The use of the hair or wool of certain varieties of goat for making valuable fabrics is noticed in the articles ANGORA and CASHMERE GOAT. The horns are used for making knife-handles, etc., and the fat is said to be superior to that of the ox for candles. In Holland, goats are employed in drawing children's coaches, to which as many as four are sometimes harnessed together, and they are sufficiently tractable and obedient to the rein.

The goat generally produces two young ones at a time. A hybrid between the goat and the sheep has been produced, and it has been described as fertile, but there is no evidence of fertility except in connection with one of the parent races.

The origin of the domestic goat is with greatest probability traced to the AEGAGRUS (*C. aegagrus*), which many naturalists confidently identify with it, and which is found on Caucasus and on many of the mountains of Asia. It is called *paseng* in Persia. Its legs are longer than those of the domestic goat; its horns are very large, larger in proportion than those of any other known ruminant.—Another wild species is the JEMLAH GOAT (*C. Jemlaica*), which inhabits the district of Jemlah, between the sources of the Sargew and the Sampoo, the most elevated range of central Asia; very similar to which, if really distinct, is the JAHRAL (*C. jahral*) of Nepal. These, however, have no true beard, although they otherwise abound in long hair. Other species or varieties of goat, of which the BOUQUETIN (q.v.) is one, are associated under the name IBEX (q.v.).—All the species are natives of the old world.

GOAT, ROCKY MOUNTAIN (*antilope lanigera*, or *aploceros lanigera*), an animal of the antelope family inhabiting the lofty peaks of the Rocky mountains of North America, from about the 40th to the 65th degree of latitude. Its size is about that of an ordinary sheep, and its general appearance is not unlike that of a sheep of the merino breed, its long straight hair hanging down in an abundant white fleece. The flesh is in little esteem as food, having a musky odor.—This animal has been called the *sheep antelope* and the *wool-bearing antelope*. It has been thought that its fleece might be available for some of the finer kinds of manufactures, and that it might be introduced with hope of advantage into the highlands of Scotland.

GOAT ISLAND, a little island of 70 acres just on the verge of Niagara falls, dividing the current where it plunges over the precipice. It is about 2,000 ft. from the Canadian and 900 from the American shore, and joined to the latter by a bridge.

GOAT-MOTH (*cossus ligniperda*), a lepidopterous insect of the same family with the ghost-moth, *hepialidæ*. The genus *cossus* has long antennæ; a large body, a very small head; the upper wings larger and longer than the lower. The larvæ feed on the wood of trees, and the pupæ are enclosed in cocoons, made chiefly of the saw-dust which the mandibles of the larvæ have produced. The goat-moth is one of the largest of British moths, measuring from 3 to 3¼ in. from tip to tip of its expanded wings. It is of a gray color, the upper wings mottled with white, and marked with many irregular black lines, the lower wings of an almost uniform brownish ash color. The larva is about 3 in. long when full grown, yellowish, the upper parts pink, the head black. The larva inhabits and feeds on the wood of willows, poplars, and elms, making holes large enough to admit the finger, and often causing the destruction of trees. It emits, when alarmed or handled, a peculiar and disagreeable goat-like odor, which cannot be removed from the hands even by frequent washings. The larva takes three years to come to maturity.

GOAT'S-BEARD. See SALSIFY.

GOAT'S RUE (*galega*), a genus of plants of the natural order *leguminosæ* sub-order *papilionaceæ*, of which one species (*G. officinalis*), a perennial herbaceous plant, about 3 ft. in height, with pinnate leaves, long pointed leaflets, racemes of generally purplish or pink-colored flowers, and upright nearly cylindrical pods, has been recommended for cultivation in Britain as a forage plant, on account of the great bulk of produce which it yields. It has, however, a peculiar smell, and is not relished by cattle unaccustomed to it. It is a native of the s. of Europe.

GOATSUCKER (*caprimulgus*), a genus of birds of the family *caprimulgidæ* (q.v.), having the upper mandible curved at the point, and furnished along each margin with a row of

strong hairs or bristles (*vibrissæ*) directed forwards, the hind toe capable of being directed forwards; the claws short, except that of the middle toe, which is remarkably long, and serrated on its inner edge, so as to form a kind of comb attached to the toe. Although the bill is very short and weak, the gape is extremely wide, as if the head itself were divided. The goatsuckers feed on insects, perhaps chiefly on moths, whence they are called *moth-hunters*, and pursue their prey either in the evening twilight or during the night, in a manner similar to bats and swallows. Like them, they seem to confine themselves very much to a limited space, in which they often pass and repass at no great height above the ground. They have great rapidity and power of flight. Of course, their great width of gape is favorable for the capture of insects. Goatsuckers are birds of light, soft plumage, in general minutely mottled with gray and brown. One species alone is found in Britain, the COMMON GOATSUCKER or EUROPEAN GOATSUCKER (*C. Europæus*), also called the Night-Churr, or NIGHT-JAR, from the sound which it produces; and not unfrequently, from the resemblance of its plumage to that of owls, the CHURN OWL or FERN OWL. It is a summer visitant of Britain, coming very late, and departing generally very early; it is more common in England than in Scotland, although its migrations extend northward to Scandinavia, Siberia, and Kamtchatka. In winter, it retires from Europe altogether, passing to the s. of the Mediterranean. It often haunts bushy places and grounds covered with brake. It scarcely makes a nest, but deposits two eggs in a depression of the ground, under shelter of a bush. Its whole length is about 10 in. and a half. This bird is the *caprimulgus* of Pliny, the *aigothelas* of Aristotle, both these names being exactly equivalent to the English goatsucker, and expressive of the ancient and long entertained popular notion, that this bird sucks the teats of goats, a notion probably founded on the habit—which, at all events, has been observed in some of this family—of hunting insects under the bellies of grazing cattle. In perching, the goatsucker sits *lengthwise* on the branch. Species are widely distributed over the world.

GOBBE, or VOANDZOU (*voandzeia subterranea*), an annual plant, allied to the kidney-bean, but of which the pod is thrust into the ground in the same manner as that of the ground-nut (*arachishypogæa*, see ARACHIS), to ripen the seeds there. It is a native of the n.e. of South America, and of some parts of the w. of Africa. Its seeds are used as food, being wholesome and agreeable when boiled.

GOB'BO, GOBBIO, or GOMBO. See HIBISCUS.

GO'BELINS. See TAPESTRY.

GOBERT, NAPOLEON, 1807–33; a French philanthropist and soldier. For the promotion of the study of French history he left legacies to the French academy and to the academy of inscriptions, the income from which was to be distributed in annual prizes to the authors of the best works on that subject. The legacy amounts to 10,000 francs per year for each of the two academies, and has been so far distributed according to his request.

GOBI, DESERT OF. See SHAMO.

GOBLINS and BOGLES, familiar demons of popular superstition, in Fr. *gobelin*, Ger. *kobold*, Gr. *kobalos*, a spirit which lurks about houses. It is also called hobgoblin, perhaps a corruption of hopgoblin. Some have derived the word goblin from the French *gober*, to swallow, to devour; and others the words elf and goblin from the Guelphs and Ghibellines, each name being used by the other party as a name of terror. Goblin is used in a serious sense by Shakespeare in *Hamlet*, where the ghost is supposed to be a "spirit of health or goblin damned." *Gobelet*, in French, is applied to juggler's tricks and instruments, and our word goblet comes from the juggler's cup.

Bogle, bogle-boe, or bugaboo, may be from the Welsh *brogwly*, to terrify; and *boe* or *boo*, a sound. Bugaboo was the popular name of wide-mouthed, ugly pictures, formerly carried in May-games. Warton says Boh was the designation of a fierce Gothic chieftain, whose name was used in after-times to frighten children. The belief in benevolent and malevolent spirits belongs to all countries, and appears to be as old as the world.

GOBO'NY, in heraldry, the same as *componé* (q.v.). A gobonated bordure is frequently carried in place of the baton sinister, not only by the lawful issue of bastards, who, after the third lawful generation, are considered entitled to make the change, but by bastards themselves. See BASTARD BAR.

GOBY, *Gobius*, a genus of acanthopterous fishes, the type of the family *gobiidæ*. This family is distinguished by the thinness and flexibility of the rays of the dorsal fin; by the union—in most of the genera—of the ventral fins, which are thoracic, into a disk more or less capable of being used as a sucker; by the want of an air-bladder; and by a long intestinal canal without cœca. The blenny (q.v.) family (*bleniidæ*) have by some ichthyologists been united with the goby family, whilst others unite with them the *discoboli* (q.v.). The true gobies (*gobius*) are generally small fishes, some of them inhabiting the shallow water of the coasts, and others found in deeper water; the species very numerous, and found in the seas both of the northern and southern hemispheres. They are very interesting on account of their habits; and are of the number of nest-building fishes, employing *algæ* and grass-wrack (*zostera marina*), in the spring season, for making their nests. When the female has deposited her eggs in the nest, the male

watches over them till they are hatched. There are several British species, the largest of them—the BLACK GOBY (*G. niger*)—about 5 or 6 in. long, some of them pretty common on all parts of the coast, and much in request for aquaria, of which they are among the most interesting occupants. They are often found in rock-pools on the coast. The disk formed by the ventral fins is often used for adhesion to stones. Most of the gobies prefer seas of clayey or muddy bottom, in which they excavate canals to pass the winter in. The species are more numerous in the Mediterranean than in the British seas.—The goby family includes the dragonets (q.v.), and several other interesting genera, among which are the *boleophthalmi* of the Chinese seas, remarkable for their power of thrusting out their eyes in order to look around them.

GOD (Lat. *Deus;* Gr. *Theos*), the self-existent and Supreme Being, creator and preserver of all things, and the object of human worship. The name is of Saxon origin. The idea is more or less definitely expressed in every language, as it may be said to be in some form or another a universal element of the human consciousness. There have been many nations, indeed, in every age of the world, that have been far from attaining any such conception of God as is expressed above. The Supreme has been to them the conception not of a single Being, but of many beings superior to man, and claiming his worship. In the general history of the world, polytheism precedes monotheism; the idea of many gods goes before the idea of one God, infinite and self-existent

The general character of polytheism is everywhere the same.—A dualistic conception of nature and life underlies it, and shows itself in varied expressions. In looking forth on nature—in looking within himself—man seems to see two principles striving for the mastery—an active and passive, a creative and recipient principle—a good and evil, a productive and destructive, a joyous and gloomy agent. On one side, there seems a power rich, benignant, and gracious, giving light to the day, verdure to the spring, abundance in autumn, scattering fecundity and blessing around; on the other side, there seems a power cruel and malevolent, quenching the light in darkness, consuming the verdure and fertility with scorching heat, or destroying them with cold. These contrasts seem eternal—they take possession of the imagination, and clothe themselves in diverse shapes. In every polytheistic religion, they will be found in the recognition of male and female, of good and evil divinities—Baal and Baaltis, Baal-Adonis and Baal-Moloch, in the old Phenician religion; Osiris and Isis and the evil principle, Typhon, in Egypt; and the more familiar opposites of Ahriman and Ormuzd, Jupiter and Juno, etc. The dualism assumes various shapes, now male and female, productive and passive; and now good and evil, conservative and destructive.

Whether this dualistic mode of conception, and the polytheistic view of nature that springs from it, be a later or an earlier type of thought than the monotheistic, has been a good deal disputed. Some see in it the corruption of monotheism—the worship of the Supreme gradually falling to a worship of the great forms of nature which most strikingly represent Him—the sun and storm, the light and darkness, etc. Others, again, regard the polytheistic as the primitive view of nature, above which man gradually rises, by the growth and exercise of his reason. There is truth in this latter view, even to those who believe that man originally received a divine revelation, which he has gradually corrupted. Polytheism is the natural religion of savage tribes throughout the world; and as man advances in civilization, he rises to purer and more comprehensive conceptions of Deity. His reason compels him to recognize the One in the many everywhere, to carry up all his conceptions into a unity. Polytheism, consequently, everywhere disappears before the march of civilization. It is incompatible with the lowest stage of speculative development.

But while the growth of reason and the rise of speculation everywhere destroy polytheism, they do not necessarily substitute a genuine monotheism—the doctrine, that is to say, of one living and true God, infinite in power, wisdom, goodness, and truth, a free personal Being exalted above the world, and apart from it, yet intimately related to all its creatures, who "suffereth not a sparrow to fall to the ground without his permission." This is the doctrine of Christian theism, as opposed alike to polytheism (the doctrine of many gods), pantheism (the doctrine that all things are God; that God is a unity, yet only a unity of comprehension, not a self-subsistent and independent unity), and atheism (the assertion that there is no God).

The course of argument on which the theistic conclusion supports itself may be sketched as follows: There are everywhere in the world the traces of order; a unity of plan or design, shown in many beautiful effects, pervades creation. Science is always more unfolding it. Of *the fact* of this order or unity of plan, there is no question. The progress of science, if nothing else, has effectually exploded the old dualistic or polytheistic conception of nature. What appeared to be the result of opposing principles, is really found to be the issue of general laws working on some great although unexplored scheme of harmony. There is no disturbance, no *disorder;* amidst the infinite diversity of nature—*order* reigns universally.

But this "order," what is it? The mere recognition of order does not necessarily imply the recognition of God—of a "Being all-powerful, wise, and good, by whom everything exists." The materialist and pantheist equally admit the fact of order, but equally deny the theistic conclusion founded upon it; and the argument, accordingly, is

carried up from nature and its facts to a higher region of discussion. Whence arises the conception of order—of design? Nature illustrates it, but nature does not itself give it. The general laws of which science speaks so much pervade all phenomena of creation, but they are not a part of these phenomena. "Order" and law are ideas which *we* convey to nature, not which nature brings to us. They come from within, not from without. It is with mind, and not with matter that we start. The latter in itself presents a mere series of endless movements. It is in the presence of mind only that it assumes meaning and *order*. Mind is the true image of the Deity. We discern *causation* in nature, because we ourselves are *agents*, conscious of exerting power. We discern *order* in nature, because we everywhere bring our conceptions into a unity, and apprehend our several modes of consciousness with reference to the indivisible self which they all involve. "In our life alone does nature live." "It is from the little world of our own consciousness, with its many objects marshaled in their array under the rule of the one conscious mind, that we are led to the thought of the great universe beyond—that we conceive this also as a world of order, and as being such by virtue of its relation to an ordering and presiding mind."

The existence of Deity, therefore, is a postulate of the human consciousness. Recognize a living mind in man, independent of matter—a *rational will*, as constituting the essential and distinguishing element of his being—and the inference is inevitable of an infinite mind—a supreme will governing the world. A true natural theology is based upon a true psychology. A philosophy which denies to man a higher existence than nature, which would make his rational consciousness the mere growth of material conditions, leaves no ground of argument for the existence of Deity—for, as Jacobi says: "Nature reveals only fate, only an indissoluble chain of causes (sequences), without beginning and without end, excluding with equal necessity both providence and chance. Working without will, she takes counsel neither of the good nor of the beautiful; creating nothing, she casts up from her dark abyss only eternal transformations of herself, unconsciously and without end. But man *reveals* God—for man, by his intelligence, rises above nature, and in virtue of this intelligence, is conscious of himself, as a power not only independent of, but opposed to, nature, and capable of resisting, conquering, and controlling her. As man has a living faith in this power superior to nature, which dwells in him, so has he belief in God—a feeling, an experience of his existence. As he does not believe in this power, so does he not believe in God; he sees, he experiences nought in existence but nature, and necessity, and fate."

The argument for the existence of God rests, accordingly, on certain fundamental principles of our mental and moral being, such principles as causation and design, or final cause. It implies a spiritual philosophy of human nature. Apart from such a philosophy, theism has no argumentative basis, however it may prevail as a tradition or superstition.

But some philosophers have sought not merely to rest the argument for the existence of God upon such principles, but to evolve it in all its completeness from them alone. From a single datum of consciousness—sometimes from a single datum of experience—they have tried to construct, by processes of mere abstract reasoning, a "demonstration of the being and attributes of God." This has been styled the *à priori* method of argument, although to all the arguments to which this name has been given it does not strictly apply. The mode of argument, again, which reasons from special effects in nature to a first cause, has been styled, in contradistinction, *à posteriori*. The argument from design, for example, as conducted by Paley and others, is *à posteriori*. The arguments of Descartes, and the "demonstration" of Dr. Samuel Clarke, are what have been termed *à priori*. Either of these modes of proof, taken by itself, has been rightly considered inconclusive by recent writers on natural theology. Mere *à priori* trains of reasoning fail to carry up the mind to any real and living conception of Deity; they yield merely a theoretical or abstract idea. Arguments such as Paley's and the Bridgewater treatises, again, are rather illustrations than arguments. They derive all their logical force from certain principles which are implied in their details, and without which these details could have no bearing on the existence of God. The very idea of Design itself is such a principle. It is the die which the mind stamps upon nature; it is not in nature itself. Any complete argument for the being of God, therefore, involves equally *à priori* and *à posteriori* elements. The former are necessary as the rational foundation of the argument; the latter are necessary to illustrate, to give life and body to the general principles which lie at the foundation.

The Christian doctrine of the godhead will be considered under the several names of TRINITY, SON OF GOD, and HOLY SPIRIT.

GOD, OFFENSES AGAINST. See SACRILEGE.

GODAVERY, or GODAVARI, one of the principal rivers of the peninsula of Hindustan, and the largest of the Deccan, rises within 50 m. of the Arabian sea, and flows s.e. across the peninsula into the bay of Bengal. Its source is in the eastern face of the western Ghauts, in lat. 19° 58′ n., and long. 73° 30′ e.; and its two mouths, diverging in lat. 16° 57′ n., and long. 81° 49′ e., enter the sea respectively in lat. 16° 48′ and long. 82° 23′, and in lat. 16° 18′ and long. 81° 46′. About 23 m. above the head of the delta, the Godavery emerges at Palaveram from the eastern Ghauts, through which it has passed with

so moderate a descent as to be navigable in either direction. The southern arm of the Godavery admits vessels drawing 8 or 9 ft.; and the northern one shows a depth of 2 or 3 ft. more. Like tropical streams in general, the river varies greatly, according to the season, in breadth and depth. But a dam or annicut (see CAUVERY) has been constructed, so as to mitigate the evil for the purposes alike of navigation and of irrigation. The length of the Godavery is about 900 miles.—For the *district* of Godavery, see RAJAMAHENDRI.

GOD-BOTE, an ecclesiastical fine, paid for crimes and offenses against God. The word bote, the same as boot, is the old Saxon bot or bote, a reparation or satisfaction—e.g., man-bote was the compensation due for the life of a man.

GODDARD, ARABELLA, b. France, 1836; noted as a pianist. She made her first public appearance in 1850. She has given concerts in most of the cities of Italy, Germany, France, and in Australia, the Sandwich islands, and the United States. She played at the great musical festival in Boston, Mass., in 1872.

GODERICH, the capital of Huron co., Ontario, on lake Huron, at the entrance of Maitland river and the terminus of the Buffalo and Goderich branch of the Grand Trunk railway; pop. '71, 3,954. It has a good harbor and steam communication with all lake ports.

GO'DESBERG, a village of Rhenish Prussia, with a fine ruin, is situated on a conical hill in the midst of the plain, on the left bank of the Rhine, and 4 m. s. of Bonn. It has a mineral spring, is a favorite summer residence, and has a pop. of 2,570. It derives its name, not from Woden, who is said to have been worshiped here, but more probably from the Gau-ding, or Goding, the district court which may have held its sittings at this place. The castle was erected by Dietrich, the archbishop of Cologne (1208–13), with materials taken from the ancient chapel of St. Michael, the ruins of which are still standing near the castle. In 1582, Gebhard, the deposed archbishop, took refuge here, and intrusted the castle to a Dutch garrison. It was, however, soon after taken by his successor, on which occasion it sustained much injury. During the thirty years' war, it was alternately in the possession of the Swedes and the Imperialists, and was finally almost demolished by the French. Only one fine tower, 90 ft. in height, is still standing. It commands a magnificent prospect of the Siebengebirge and great part of the valley of the Rhine, and is, on this account, much visited by strangers.

GODFATHER AND GODMOTHER, the person who, by solemnly presenting to the minister of baptism the candidate for that sacrament, which is regarded as a new spiritual birth, is reputed to contract towards the newly baptized the relation of spiritual paternity or maternity. The effects of the usage are differently estimated in the different communions.

In the Roman Catholic church, the parties presenting a child for baptism are called, from the spiritual *parental* relations which they contract, "godfather" (*patrinus*) and "godmother" (*matrina*); and from the *engagement* into which they enter on behalf of the baptized, "sponsors" (*sponsores*). The spiritual bond resulting from this relation is regarded as a species of kindred (whence the name *gossip*, or God-sib, *spiritually akin*), and constitutes, by the canon law, an impediment of marriage between the sponsors upon the one hand and the baptized and the parents of the baptized on the other. Anciently, this impediment arose also between the sponsors themselves, who were often very numerous, and extended besides to the other members of the kindred; but the council of Trent limited the number of sponsors to "one or two," and restricted the matrimonial impedient within the limits above described. The parents of the baptized are not permitted to act as sponsors in the Roman Catholic church, one of the objects of the institution being to provide instructors in case of the death of parents; nor are members of religious orders, because their inclusion within their convent is supposed to render it impossible for them to discharge permanently and regularly the duties of instructors to the newly baptized. In the Roman Catholic sacrament of confirmation also, the candidate is commonly presented by one sponsor, generally, though not necessarily, of the same sex with the candidate for confirmation. It is difficult to assign the precise date of the origin of this institution. No trace of it occurs in the New Testament, but it is believed to have been in use in the 2d c., and it certainly was an established practice in the fourth.

In the church of England, two godfathers and a godmother are required at the baptism of a male, and two godmothers and a godfather at that of a female. In order to be admitted as such, the person must be baptized, must be of full age, acquainted with the Lord's prayer, creed, and ten commandments, and familiar with the fundamental truths of Christianity. No impediment of marriage arises in the English church from the relation of the sponsors to the baptized. Practically, the usage in the church of England has, for the most part, degenerated into a mere form; godfathers and godmothers usually giving themselves little concern in the future fate of the infant whose spiritual condition they become bound to watch over. In the church of Scotland, and other non-Episcopal churches, the parents of the infant occupy the place of sponsors; the father expressly taking the vows on the occasion.

GODFREY, THOMAS, d. 1749; a native of Philadelphia and a mathematician who made a valuable improvement in the quadrant, for which he received a reward of $1,000 from the British royal society. His quadrant was the same in principle and application as the sextant.

GODFREY OF BOUILLON, duke of Lower Lorraine, b. about 1061, at Baisy, a village of Belgian Brabant, was the eldest son of count Eustace II. of Boulogne, and Ida, sister to Gottfried or Godfrey, the hunchback, duke of Lower Lorraine and Bouillon, whom he succeeded in the government of the latter duchy in 1076. He served with great gallantry in the armies of the emperor Henry IV., both in Germany and Italy; and it was from his hand that the competitor for the imperial crown, Rodolf of Swabia, received his death-blow at the battle of Merseburg. When the first crusade was set on foot, the fame of his exploits caused him to be elected one of the principal commanders. In order to defray the expenses of the crusade of 1095, he mortgaged Bouillon to the bishop of Liège, and set out, accompanied by his brothers Eustace and Baldwin, in the spring of 1096. For a detailed account of his career up till the taking of Jerusalem, see CRUSADES. Eight days after the taking of Jerusalem, Godfrey was proclaimed king by the unanimous voice of the crusading army; but the piety and humility of the conqueror forbade him to "wear a crown of gold where his Savior had worn one of thorns." He declined the regal title, contenting himself with that of defender and guardian of the holy sepulcher. The sultan of Egypt, learning that the army of 300,000 crusaders who had taken Antioch had dwindled away to 20,000, advanced against them with an army said to have amounted to 400,000 men; but Godfrey gave him battle in the plain of Ascalon, and the victory gained on this occasion put him in possession of the whole of Palestine, a few fortified towns only excepted. He now directed his endeavors to the organization of the new state; he installed a patriarch, founded two cathedral chapters, built a monastery in the valley of Jehoshaphat, and drew up laws. He died in 1100, and his body was interred on Mt. Calvary, near the holy sepulcher. History represents this prince as a model of piety, valor, and all kingly virtues; and his praises have been worthily sung by Tasso in his *Jerusalem Delivered.*

GODI'VA, LADY, patroness of Coventry. About the year 1040, Leofric, earl of Mercia, and lord of Coventry, then an important market-town, imposed certain onerous services and heavy exactions upon the inhabitants, of which they loudly complained. His wife, the lady Godiva, having the welfare of the town at heart, besought her husband to give them relief, and was so earnest in her entreaties that at length, to escape from her importunities, the earl said he would grant her the favor, but only on condition that she would ride naked through the town, supposing, from the modesty of lady Godiva, that he had required an impossible condition; but he was surprised with the answer, "But will you give me leave to do so?" As he could not in justice refuse, she ordered that proclamation be made that on a certain day no one should be away, or even look, from their houses, when, clothed only by her long hair, she rode through the town; and her husband, in admiration of her intrepid devotion, performed his promise. This circumstance was commemorated by a stained-glass window, mentioned in 1690, in St. Michael's church, Coventry; and the legend that an unfortunate tailor, the only man who looked out of a window, was struck blind, has also found commemoration in an ancient effigy of "Peeping Tom of Coventry," still to be seen in a niche of one of the buildings. By a charter of Henry III., 1218, a fair is held at Coventry, beginning on Friday of Trinity-week, and lasting eight days. The fair was opened with a grand civic procession, a part of which was, in 1678, the representation of the ride of lady Godiva. These processions were continued at intervals of from three to seven years, until 1826. Some beautiful woman, who represented lady Godiva, was the principal figure, but many other historical and emblematic personages were introduced. In 1848, the procession was revived with great splendor, and attracted 15,000 strangers. The ceremony has, however, now fallen into disrepute, and the procession, when celebrated, is a vulgar and tawdry affair.

GODKIN, EDWARD LAURENCE, b. Ireland, 1831; educated at Queen's college, Belfast. He came to the United States in 1856, and traveled through the southern states; afterwards studied law, and was admitted to the bar. He is now chief editor of the *Nation*, a weekly journal published in New York.

GODMAN, JOHN D., 1794–1830; b. Md; was one of the defenders of fort McHenry. He was professor in the medical college of Ohio, and in Cincinnati started the *Western Quarterly Reporter*. He was subsequently professor in Rutgers medical school in New York. He was the author of many articles in the *Encyclopedia Americana; American Natural History; Bell's Anatomy, with Notes; Anatomical Investigation;* and *Rambles of a Naturalist.*

GÖDÖLLÖ, a market-town in Hungary, formerly the residence of the princely family Grassalkovich, is distinguished for its manorial castle as well as for the surrounding parks. It was on the woody heights of Gödöllö and Isaszeg that the combined armies of Austria, under prince Windischgrätz and count Jellachich, were defeated in two bloody battles by the Hungarians under Görgei. On the eve of victory, governor Kossuth held a conference with the generals Görgei, Klapka, and Damjanich, for laying

down the principles of the famous declaration of independence, issued on the 14th of April, 1849, by the diet at Debreczin. It was this declaration which served the emperor of Russia as a pretext for the invasion of Hungary. Pop. '69, 3,661.

GODOLPHIN, SYDNEY, Earl of GODOLPHIN, an English statesman, was descended from an old Cornish family, and was born, it is thought, about 1640. After the restoration, he became one of the grooms of the bed-chamber to Charles II., was appointed one of the secretaries of state in 1664, and soon after first commissioner of the treasury; was twice dispatched to Holland in 1678 on business of importance, and argued and voted for the exclusion of the duke of York from the succession in 1680. Nevertheless, when the latter mounted the throne, Godolphin (now baron Godolphin of Rialton, in Cornwall) was made lord-chamberlain to the queen; and on the landing of the prince of Orange, he was one of the commissioners sent by king James to treat with the invader—a difficult piece of business, which he is considered to have managed with much tact and prudence. William was not slow to perceive the admirable abilities of Godolphin, and in 1690 appointed him first lord of the treasury. In 1695 he was one of the seven lords justices for the administration of the government during the king's absence. In 1702, on the accession of Anne, he accepted the office of lord high treasurer, mainly at the solicitation of Marlborough, who paid him a splendid compliment by declaring that otherwise he could not venture to assume the command of the British armies, as he could depend on him alone for punctual remittances. Godolphin fully realized the expectations of the great captain. He raised the public credit, induced the queen to contribute £100,000 towards the war, firmly opposed the selling of offices and places, and increased the stipends of the inferior clergy. In 1706 Godolphin was raised to the dignity of earl of Godolphin and viscount Rialton; after this period, he took part with the whigs, as being more patriotic and English than the tories. The contest between him and Harley for the premiership resulted finally in the defeat of Godolphin, who was dismissed from office in 1710. He died at St. Albans, Sept. 15, 1712, and was interred in Westminster abbey. The title became extinct in his son Francis, second earl of Godolphin. Godolphin was the best business-man of his age. He had the clearest and quickest understanding, and liked to do his work in such a way that it would not require to be done over again. In an age of corruption, Godolphin was believed to be incapable of bribery, and he never employed as his agents any except men of integrity. His "talent for silence" equaled William's own.

GODON, SYLVANUS W., b. Penn., 1810; entered the navy and rose to be rear-admiral, retiring in 1871. He commanded the Powhatan at the battle of Port Royal, and the Susquehanna in the fort Fisher engagements.

GODOY. See ALCUDIA.

GOD SAVE THE KING (or **QUEEN**), the noble national anthem of Great Britain, and by adoption that of several of the German states, and which is played and sung in every part of the British empire alike on solemn and festive occasions, has been a subject of controversy with respect to its origin. Its words are apparently imitated from the Domine Salvum of the Catholic church service. In England, the authorship has been generally attributed to Dr. John Bull, born 1563; in 1591 organist in queen Elizabeth's chapel; 1596, professor of music in Gresham college, and chamber-musician of James I. About the period of the discovery of the gunpowder plot, he composed and played on a small organ before the king an ode beginning with the words, "God save great James our king." He died at Lübeck, 1622. It does not appear, however, that this or any other old composition of a similar title had any connection with that which we now possess. Chappell, in his *Popular Music of the Olden Time*, and Dr. Fink, a German musical antiquary, have settled the question; the honor of this great work, both words and melody, must be given to Dr. Henry Carey, an English poet and musician, born in London about 1696, died 1743. The words and music were composed in honor of a birthday of George II., and performed for the first time at a dinner given on that occasion in 1740 by the Mercers' company of London. The words and music were first published in the *Harmonia Anglicana*, 1742, and appeared in the *Gentleman's Magazine*, 1745. The air, according to Dr. Arne, has preserved its original form, but its harmonies have been modified by various artists; and the words were changed on the accession of William IV., and on that of queen Victoria.

GOD'S TRUCE (Lat. *Treuga, Dei*, or *Treua Dei*, from the Ger. *Treu*, true), one of the most singular among the institutions of the middle ages, which prevailed specially in France and the Germanic empire, but was also received for a time in the other countries of Europe. It consisted in the suspension for a stated time, and at stated seasons and festivals, of that right of private feud for the redress of wrongs, which, under certain conditions, was recognized by mediæval law or usage. Private feuds, it is true, could only, by the mediæval law, which was called *faustrecht* and *fehderecht*, be undertaken when judicial redress had failed or could not be enforced, and after formal notice had been served upon the party against whom they were levied. But even with this limitation, private feuds multiplied exceedingly. The public peace was subject to constant interruption; the weak were without resource; the strong bore down all by the terror of their arms; and the whole social framework was so utterly disorganized, that men

by one of those religious impulses of which this age offers so many examples, fell back upon the aid of the church, and invoked her influence, as the only effectual means of staying the evil. It was in this crisis that the "God's Truce" originated. In the end of the 10th c., a council assembled at Limoges, at which the princes and nobles bound themselves, by solemn vow, not only to abstain from all unlawful feuds, but also to keep the peace mutually towards each other, and to protect from violence all defenseless persons, clerics, monks, nuns, women, merchants, pilgrims, and tillers of the soil. A similar engagement was entered into in a council at Orleans in 1016; and the whole body of the bishops of Burgundy enforced it upon their flocks everywhere throughout that duchy. A plague which visited a great part of Europe soon afterwards gave a fresh impulse to the movement; and in the year 1033, the "Holy Peace" was almost universally received, and for a time continued to be religiously observed. But as the old abuse began to revive by degrees, it was felt that the observance would carry with it more of religious authority, if, instead of being, as it had originally been instituted, universal, it was limited to certain times and days, which themselves had certain religious associations connected with them. Accordingly, in 1041, the bishops of Aquitaine limited the God's Truce to the week-days specially consecrated by the memory of the Passion and Resurrection of Christ—that is, from the sunset of Wednesday to sunrise of Monday. The same decree was renewed at Narbonne in 1054, and at Troyes in 1093. At Clermont, in 1095, it was extended to the whole interval from the beginning of Advent to the Epiphany, and from the beginning of Lent to Pentecost, to which times were afterwards added several other festivals. These enactments were adopted or renewed at several later councils; and although they were often disregarded, it is impossible to doubt that they had a wide and lasting influence in mitigating the evil against which they were directed. This singular institution fell gradually into disuse, and at last disappeared altogether, when the right of private redress was restricted, and at last entirely abolished, by the law of the empire.

GODWIN, Earl of Wessex, a famous Saxon noble, was b. towards the end of the 10th century. Originally, it is said, he followed the occupation of a cow-herd; but having found means to ingratiate himself with Ulfr, the brother-in-law of king Canute, the latter gave him his daughter in marriage, and he soon became one of the most powerful of the English nobles. More than any other person, he contributed to the elevation of Edward to the English throne (1044, A.D.); and the principal reward of his services was the marriage of his beautiful and accomplished daughter Editha with the English king. This union, however, was not a happy one. Editha was cruelly neglected by Edward, and her father, on account of his dislike of the Normans, incurred the royal enmity. His estates were seized, and given to favorites, and he and his family fled. Queen Editha was made to feel even more bitterly than any one the misfortunes of her family. Her own husband seized her dower; he took from her her jewels and her money, "even to the uttermost farthing;" and allowing her only the attendance of one maiden, he closely confined her in the monastery of Wherwell, of which one of his sisters was lady-abbess. Meanwhile, shoals of Normans visited England for the purpose of making, or rather getting fortunes. Among Edward's most favored guests for a time was duke William of Normandy, better known as William the Conqueror. The banished earl, however, had not been idle; through frequent correspondence with his countrymen at home, he kept alive the antipathy of the English to the Norman favorites of Edward, and in the summer of 1052 he landed on the southern coast of England. The royal troops, the navy, and vast numbers of the burghers and peasants, went over to him; and finally the king was forced to grant his demands. The Normans were for the most part expelled from the country, the Godwin family was restored to all its possessions and dignities; and at a meeting of the Witenagemôte, "the earls and all the best men of the land" declared that the foreigners alone were to be held guilty of the late dissensions that had distracted the country. Godwin died April 7, 1054. His son Harold was for a few months Edward's successor on the throne.

GODWIN, Mary Wollstonecraft, 1759–97; b. England; became a teacher and governess; and in 1786 published *Thoughts on the Education of Daughters;* afterwards *Mary*, a novel; *Original Stories*, and translations from Lavater. Her most important work was a *Vindication of the Rights of Woman.* Having great sympathy with the ideas that instigated the French revolution she went to Paris, where she became the mistress of an American known as Imlay. He deserted her and William Godwin married her. She died in her 38th year in giving birth to a daughter who became the wife of the poet Shelley.

GODWIN, Parke, b. N. J., 1816; educated at Princeton college, graduating in 1834, studied law and was admitted to practice, but preferred literary pursuits. He married a daughter of William Cullen Bryant, and from 1837, with occasional intervals, was for many years connected in an editorial capacity with the *New York Evening Post.* He edited in 1843–44 *The Pathfinder*, a literary journal, and was for some years a contributor to the *Democratic Review.* Of *Putnam's Magazine* he was for a considerable time the principal editor, and always a contributor. Two volumes of his critical and miscellaneous essays in this magazine have been collected under the title of *Out of the Past.* Besides these journalistic labors, he has translated and edited Goethe's *Autobiography;*

Zschokke's Tales; Undine Sintram and his Companions, and compiled a *Cyclopædia of Biography*, and has written, among other works, *A Popular View of the Doctrines of Fourier Constructive Democracy;* and *Vala, a Mythological Tale*. Many years ago he began an elaborate *History of France* of which only the first volume has been published.

GODWIN, WILLIAM, an English author, was b. at Wisbeach, in Cambridgeshire, Mar. 3, 1756. His father and grandfather were Presbyterian ministers, and he was educated to the same profession, first at a school at Norwich, to which place his father had removed in 1767, where he made rapid progress in classical studies, and afterward at a Presbyterian college at Hoxton, where he pursued his theological studies. From 1778 to 1783, he was minister to a congregation in the neighborhood of London; but the zeal with which he first entered upon his duties declined, and a change in his theological opinions made it necessary for him to resign his charge. His only resource was to remove to the metropolis, and engage in literature. His first work, a series of *Historical Sketches*, in the form of sermons, was unsuccessful, and he was reduced to penury and despair; but they made him acquainted with Fox, Sheridan, and other Whig leaders, and he turned his attention to politics. The American revolution, closely followed by that of France, excited the public mind, and Godwin wrote his *Inquiry Concerning Political Justice*, 1793. This was followed by *The Adventures of Caleb Williams*, a remarkable novel, intended to illustrate the political views advanced in the *Political Justice*. An able defense of Horne Tooke and others, published in the *Morning Chronicle*, advanced his reputation; and in 1797 he published *The Inquirer*, a collection of essays on morals and politics. About this time, he formed an alliance with Mary Wollstonecraft, the celebrated author of the *Rights of Woman*, and adopted and defended her extreme social views. After some months, however, they yielded so far to custom as to be married. His wife died a short time after in giving birth to a daughter, who afterwards became the second wife of the poet Shelley. In 1799 he published *St. Leon*, a romance; and the next year visited Ireland, where he associated with Curran, Grattan, and other eminent Irish political leaders. He also consoled himself for the loss of his wife by writing her memoirs. In 1801 he married again, and had a son, who died of cholera in 1832. To secure a more certain support, Godwin and his wife opened a circulating library, but he also worked indefatigably with his pen to the end of his life. He wrote many school-books, an admirable *Life of Chaucer* (1801); *Fleetwood*, a novel, 3 vols. (1805); *Mandeville*, in 1817; a *Treatise on Population*, a refutation of Malthus, in 1820; a *History of the Republic of England*, in 4 vols. (1824–28); *Cloudesley* (1830); *Thoughts on Man* (1833) As he grew old, he modified his opinions on politics and society, and especially on marriage, which he warmly commends in some of his later works. Being now 77 years old, he was appointed to a place under government, which removed him from the apprehension of want; but he knew not how to be idle, and wrote *Deloraine*, a novel, and the *Lives of the Necromancers*. Many of his works were translated into foreign languages. He died in London, April 7, 1836.—See *William Godwin*, by C. Kegan Paul (1876).

GOD'WIT, *Limosa*, a genus of birds of the family *scolopacidæ*, with very long bill, slightly curved upwards, and long slender legs, great part of the tibia bare. All the species frequent marshes and shallow waters, chiefly those of the sea-coast, where they seek their food by wading and by plunging the long bill into the water or mud like snipes. They sometimes also run after small crustaceans or other animals, and catch them on the sands, from which the tide has retired. Two species occur in Britain, the BLACK-TAILED godwit (*L. melanura*) and the BAR-TAILED godwit (*L. rufa*), both birds of passage, and not unfrequent visitors of the marshy parts of the east coast of England, where the first occasionally breeds; but both generally breed in more northern countries, and are seen in Britain chiefly in their migrations northward and southward. Both species are very widely distributed over Europe, Asia, and Africa. The females are rather larger than the males, and the whole length of the female black-tailed godwit, which is rather the largest species, is about 17 in., the bill alone being 4 in. long. They are much esteemed for the table, and are sent from Holland to the London market, which also receives some from the fens of Lincolnshire.

GOEBEN, AUGUST VON, b. Hanover, 1816; was in the Prussian military service in 1833, but afterwards joined the Carlists, and was wounded and taken prisoner. After the end of the Carlist war he was liberated, and on his return to Germany, wrote an account of his Spanish experiences. Re-entering the Prussian army, where he served on the staff, he took part in the campaign against the revolution in Baden, and became in 1855 chief of staff of the 6th army corps. In 1860, he was directed to accompany the army of the Spanish general O'Donnell, in the campaign in Morocco. In 1863 he commanded the 26th brigade of infantry; the following year he was engaged in the war against Denmark, and became lieut.gen. and commander of the 13th division. At the head of this division he entered Hanover in 1866, and distinguished himself on several occasions. In the Franco-German war, as commander of the 8th army corps, he held an important and conspicuous position, and distinguished himself in the battles of Saarbrucken and Metz. In Jan., 1871, Goeben was appointed commander of the army of the north, and fought a decisive battle at St. Quentin (Jan. 19), when he defeated

Gen. Faidherbe, and caused the disbanding of the French northern army. He is now in command of the 8th army corps, located in Rhenish Prussia, head-quarters at Coblentz.

GOENTOER, a volcano in the island of Java 100 m. s.e. of Batavia, about 7,000 ft. high, and in almost constant eruption.

GOES, HUGO VAN DER, lived in the latter part of the 15th c., a Flemish painter and the successor of Van Eyck. His greatest work is the *Crucifixion* in a church at Bruges.

GOES, or TERGOES, a t. and fortified seaport of Holland, in the province of Zeeland, is situated in a fruitful district in the island of South Beveland, about 3¼ m. from its northern coast, and 17 m. w. of Bergen-op-Zoom. It is well built; has a harbor formed by a canal communicating with the East Scheldt, ship-building docks, besides an active trade in hops, salt, and agricultural produce. Pop. '75, 6,239.

GOETHE, JOHANN WOLFGANG VON, the acknowledged prince of German poets, and one of the most highly gifted and variously accomplished men of the 18th century. He was born in the year 1749, at Frankfort-on-the-Main, where his youthful years were spent. His father, Johann Kaspar Goethe, was an imperial councilor, in good circumstances, and in a respectable position. In the year 1765 he went to the university of Leipsic, of which Ernest and Gellert were then the most notable ornaments. As a student, he pointed, by external profession, towards the law; but his real studies were in the wide domain of literature, philosophy, and above all, life and living character. In the year 1770, he went to Strasburg to finish his juridical studies; but here also anatomy and chemistry, Shakespeare, Rousseau, and architecture—anything rather than the statute-book—occupied his time and exercised his soul. Here it was that one of the earliest, certainly the most famous of those youthful love-adventures took place, which, in his biography, as in that of Robert Burns, play such a prominent part—the well-known affair of Frederica Brion of Sesenheim. With regard to these matters in general, it may be said that he was more readily moved to love than intense in love; and that the objects of his admiration generally seem to have had more reason to boast of the delicacy of his susceptibility, than of the perseverance of his devotion. How far there was anything more than commonly culpable in these connections, will always be a question; certain it is that they will always tarnish to some extent the otherwise fair reputation of the poet. The female sex will never forgive the man who was so light to lend his heart, and so fearful to give his hand; and British morality will always be inclined to pass a severe judgment on the man who, professing the profoundest subjection to law and order in everything else, seems to have shrunk from the golden clasp of legitimate marriage as from some conventional shackle, which a free and great nature should avoid. In the year 1771 the young poet, now 22 years of age, took his degree as doctor of laws, and went for a short while to Wetzlar on the Lahn, the seat of the imperial chamber of the then German empire, and which afforded peculiar facilities for young men engaged in the study of public law. Here, however, as in other places, his knowledge of the human heart, and of human character, altogether overgrew his professional studies; and Wetzlar became to him the scene of the famous *Sorrows of Werther*, a glowing leaf from the life of the human soul, full of interest and beauty at all times, but which, in the then state of European thought and feeling, stirred the whole literary mind of Europe like a breeze sweeping over a forest. The book was not published till 1774. After returning from Frankfort Goethe spent some years in his native city, engaged chiefly in literary productions. His first great work was *Götz von Berlichingen*, translated into English by sir Walter Scott, published at Frankfort, 1773, which at once set the Germans free from the painful constraint of French and classical models, and opened up to them that career of bold originality, which they have since prosecuted in so many departments of literature, learning, and speculation. In the year 1775 Goethe, who had had the good-fortune to gain the good opinion of Karl August, grand duke of Saxe-Weimar, accepted an invitation from that prince to settle in his little capital, since become so famous as the Athens of the great legislative age of German literature. Here the poet became a little statesman; and, occupying himself in various ways in the service of his benefactor, passed quickly through stages of court preferment, till, in 1779, he became "actual privy-councilor," at the age of 30, holding the highest dignity that a German subject could then attain; a great, a rich, and an influential man. In 1782 he received a patent of nobility; and in the following years, till 1788, traveled much in Switzerland and Italy, of which last journey we have the beautiful fruits in *Iphigenia*, *Egmont*, *Tasso*, and the *Venetian and Roman Elegies*. Of this last work, thoroughly German both in form and feeling, the heroine was Christiana Vulpius, a highly attractive though not a highly gifted woman, who bore him a child—his eldest son—in 1789; but whom, though he always treated her as his wife, he did not formally marry till 1806. In 1792 he took part in the German campaign against France, of which he has left a memoir. In the year 1815 he was made minister of state. After the death of the grand duke in 1828 he lived much in retirement, occupied occasionally with poetry, but much more intensely and constantly with the study of nature and the fine arts, which from his earliest years had possessed the strongest attractions for him. He died in Mar., 1832, in his eighty-fourth year.

To give a detailed account of the literary and scientific productions of Goethe's pen, is altogether impossible within the limits of the present work; much less can we attempt any detailed criticism of these works. The best source of reference to the mere English reader is the biography of the poet, by G. H. Lewes; along with which may be taken Goethe's interesting conversations with Eckermann, translated by Oxenford. On the general character and literary position of Goethe, however, a few words are necessary. It is as a poet, no doubt, that this remarkable man is generally known and recognized in this country; but it is not as a poet only that a just measure can be taken of his intellectual caliber or of his European significance. It is as poet, thinker, critic, and original observer of nature, all combined in one admirable harmony, that his rare excellence consists. We do not find in literary history any intellect that can fitly be placed on the same platform with Goethe; that presents, in such grand and graceful completeness, so much severe thought, combined with so much luxuriant imagination; so much accurate science with so much playful fancy; so much simplicity with so much art; so much freshness and originality of productive power, with so much justness and comprehensiveness of critical judgment. As a dramatist Goethe will not compare for a moment with the great masters of that art among ourselves. His English biographer detects in the constitution of his mind, most justly, "a singular absence of historic feeling and dramatic power." Not less correct is the judgment of the same writer when he says: "Goethe was attached to character and picture, indifferent to action and event." In this respect, the poet was a true type of his nation. As contrasted with the French and English, the Germans are deficient in nothing so remarkably as in stirring passion and progressive energy; the relation of Goethe to Shakespeare and the English dramatists is exactly the same. Nevertheless, *Faust* is a great poem, even a great dramatic poem, for it is full of dramatic scenes, though they are not sufficiently moved by the living current of dramatic action. *Faust* is essentially a German poem, and yet a poem which all foreigners can read and enjoy. It is the great drama of that moral and metaphysical questioning which thoughtful minds must go through in all times and places, but which has received the fullest and most fruitful development in modern Germany. Of the other poetical works of Goethe, *Iphigenia*, *Hermann and Dorothea*, and *Tasso*, are those which most strongly bear the type of the ripe manhood of the author. The form and style of these classical works are characteristically Greek; by which we mean they are chiefly remarkable for profundity of thought and truth of feeling, expressed in the most simple, graceful, and unpretending manner. In soul, however, they are essentially German; and the most deep-thinking of the Germans are always the first to claim Goethe as the most German of all German poets in spirit, though very few great German writers have so carefully avoided the most characteristic German defects of style. In the extraordinary value which he attaches to "the form" Goethe authenticates himself everywhere as at once a great modern Greek and a great artist.

Goethe is a poet who is thoroughly relished only by those who understand thoroughly the German language, and whose minds are not so typically English as to exclude a ready sympathy with German thoughts and feelings. With general English readers, for various reasons, Schiller will always be the favorite poet. Nevertheless, there has been a considerable amount of literary power in this country spent in the translation of Goethe's works, specially of his great work, the *Faust;* of this, at least a dozen translations exist, the most notable being by Bayard Taylor, Anster, Blackie, and Hayward. Some of the most beautiful of the lyric poems have been aptly rendered in a conjunct volume by prof. Aytoun and Theodore Martin.

GOETZ, HERMANN, 1840–76; b. Prussia, and at an early age became a musician and a student under Hans von Bülow. He is best known as the author of an opera founded upon Shakespeare's *Taming of the Shrew* produced at Mannheim in 1874 and successful all over Europe. He left an unfinished opera (concluded by a friend) called *Francesca da Rimini.*

GOFFE, WILLIAM, 1605–79; b. England; one of the officers in the parliamentary army and a judge on the trial of Charles I. After the restoration, he came to America and enjoyed the hospitality of gov. Endicott of Massachusetts. He was accompanied by his father-in-law, Edward Whalley. Rewards were offered for their arrest, and for years they were hiding in caves and other places of concealment in Connecticut. In 1675 at a religious service in Hadley, the Indians came upon the town, and were about to murder the whites when an old man with a long white beard suddenly appeared in the church, rallied the whites, and himself led the charge upon the red men, who were put to flight. In the moment of victory, Goffe—for he it was—disappeared and was never afterwards seen.

GO'GARI, a river rising in Nepaul, about lat. 27° 20′ n., and long. 86° 46′ e., joins the Coosy, an affluent of the Ganges, in lat. 25° 24′ n., and long. 87° 16′ e., after a course of 235 miles.

GOG AND MAGOG, names several times used in the Bible, and the names given to the famous figures of giants in Guildhall, London. Magog is spoken of by the writer of Genesis as a son of Japheth; Ezekiel speaks of Gog, prince of Magog; Gog and Magog are spoken of in the Revelation. Magog is considered by some the father of the Scythians

and Tartars. The Persians have also been derived from Magog, and the Goths from Gog and Magog. The Caucasus is supposed by Bochart to derive its name from Gog Chasan—fortress of Gog. Our Guildhall giants boast of almost as high an antiquity as the Gog and Magog of the Scriptures, as they, or their living prototypes, are said to have been found in Britain by Brute, a younger son of Anthenor of Troy, who invaded Albion, and founded the city of London, at first called Troy-novant, 3,000 years ago. Albion, at this period, was inhabited by a race of tremendous giants, the descendants of the thirty-three infamous daughters of the emperor Diocletian, who, having murdered all their husbands, were sent to sea in a ship, and were happy enough to reach Albion, where, cohabiting with wicked demons, they gave birth to the giants, whom the Trojans finally conquered, leading the last two survivors prisoners to London, where they were chained to the gates of a palace on the site of Guildhall, and there kept as porters. When they died, their effigies were set up in their place. This is Caxton's account; but there is another, which represents one of the giants as Gogmagog, and the other as a British giant who killed him, named Corineus. However the fact may have been, the two giants have been the pride of London from time immemorial. On London bridge, they welcomed Henry V. in 1415; they welcomed Henry VI. to London in 1432; and in 1554, Philip and Mary. In 1558 they stood by Temple Bar, when Elizabeth passed through the city gate. The old giants were burned in the great fire, and the new ones were constructed in 1708. They are 14 ft. high, and occupy suitable pedestals in Guildhall. The ancient effigies, which were made of wicker-work and pasteboard, were carried through the streets in the lord mayor's shows, and copies of the present giants were in the show of 1837. Formerly, other towns in England had their giants, and there are famous and some very large ones in several continental cities. The Antigonus of Antwerp, is 40 ft. high, and was formerly carried in the most solemn religious as well as civic processions. Gayant, the giant of Douai, is 22 ft. high. There are also giants, and families of giants, at Lille, Malines, Brussels, etc., each connected with some popular tradition of their respective cities. The arms of Antwerp, a castle with several hands, are connected with the legend of the giant who lived in the castle, and cut off the hands of those who failed to pay his exactions. Though it is now impossible to ascertain the facts, there can be little doubt that all these civic giants are exaggerated representatives of real persons and events.

GO'GO, a large t. and a seaport of British India, in the presidency of Bombay, is situated on the w. shore of the gulf of Cambay, and has safe anchorage during the s.w. monsoon, with smooth water and a muddy bottom. It is in lat. 21° 39' n., and long. 72° 15' east. Pop. '72, 9,571.

GOGOL, NIKOLAI, a Russian author of great and original genius, was b. at the village of Wassiljewka, in the government of Poltova, in 1810. On finishing his studies, he went to St. Petersburg, and solicited government employment, which was refused, on the ground, that "he did not know Russian." Shortly after, he proved that the officials were in the wrong by publishing a collection of novels and sketches, entitled *Vechera na Khutorie* (Evenings at a Farmhouse). The first and most important of these tales contains a vivid picture of Cossack manners, enabling us, according to M. Sainte-Beuve, to comprehend the profound antipathies that have for ages characterized the relations of certain branches of the Slavic family to each other. Then come the *King of the Gnomes;* the *History of a Fool,* which is more a satire than a psychological study; and *The Housekeeping of Former Times,* a little master-piece of its kind. The success of *Evenings at a Farmhouse* was immense, and Russian critics compared Gogol's style to that of Washington Irving. It was followed by *Mirgorod,* a supplementary volume, of the same character, containing stories full of poetry, and exciting astonishment not less by the vigor and grasp of mind displayed in the delineation of character, than by the extraordinary skill with which the plots are formed and unraveled. Gogol now turned his attention to the dramatic art, and produced the *Revisor,* a comedy of brilliant genius, whose appearance on the stage excited quite a furor. The purpose of this piece was to expose the rooted abuses of the internal administration of Russian affairs. The emperor Nicholas was the first to applaud its morality, and showed his approbation by appointing the author professor of history in the university of St. Petersburg. While holding this office, he published, in 1842, *Pokhozhdeniya Chichagova ili Mertvuiya Dushi* (Adventures of Chichagov, or Dead Souls), of which a bad translation appeared in English in 1854, under the title of *Home-life in Russia*). The aim of this novel was to extinguish serfdom by ridicule. Exhausted by his labors, Gogol sought permission to travel, and visited Italy, where he took up his residence. There, however, his opinions appear to have undergone a change. From being an ardent Russian liberal and reformer, he became an apologist of despotism, an apostasy which he lived to regret. After the commotions of 1848, he returned to Russia, and died at Moscow in 1851.

GOGRA. See GHOGRA, *ante*.

GOHA'NUH, a t. of British India, in the district of Rohtuk, in the Punjab, 45 m. n.w. of Delhi. It is situated on the Rohtuk branch of the Delhi canal, and near the northern extremity of a great depression of the soil, extending about 50 m. southwards. Pop. 6,668.

GOHILWAR, or GOHELWAD, a region of Gujerat in India, comprising several tributary states, lies on the eastern coast of the peninsula of Kattywar. The native states in the "Gohilwar division" cover an area of about 3,000 sq.m., and have a population of upwards of 450,000. The soil of Gohilwar is fertile. Most of the rivers dry up in the hot season; the Setroonjee is the largest river. The chief mountains are Wulluk, Palitayna, and the Servi ranges. The capital of Gohilwar, Bhaonagar, is within the British district of Ahmedabad.

GOIL, LOCH, a small but highly picturesque loch in Argyleshire, Scotland, is a branch of loch Long (q.v.), and is 6 m. in length, and about 1 m. in breadth. Its shores are for the most part wild and rugged; but the general character of the scenery is modified by extensive natural woods of hazel. The mountains in the neighborhood rise to the height of about 2,500 feet. Lochgoilhead is a favorite summer watering-place. It may be visited by steamers from Glasgow.

GOI'TER, an enlargement of the thyroid gland (q.v.) occupying the front of the neck, and sometimes of such a size as to project downwards over the breast, and even to admit of being thrown over the shoulder. Goiter is for the most part an endemic or local disease, being found in the mountainous regions of the Alps, Andes, and Himalaya, especially, it is said, where lime prevails largely as a geological formation. The proofs of goiter being connected with a calcareous impregnation of the drinking-water are rather strong, but perhaps not quite sufficient, especially as regards this country, though the chief seat of goiter in England, Derbyshire, is subject to this alleged cause. Goiter is met with, endemically, to a slight extent, in various parts of Scotland; but on a very small scale indeed as compared with Switzerland, in which it is a very important deformity, especially when connected with cretinism (q.v.). Goiter is of two kinds: the one due to increased development of the vessels of the gland, the other to the growth of cysts (q.v.) in its substance. To these might perhaps be added a third, which is found in connection with functional disease of the heart, but which is perhaps only a variety of the vascular goiter. The usual treatment of goiter is by the administration of very minute doses of iodine (q.v.) for a long time together. The use of this remedy is due to Coindet of Geneva, who recognized it as the principal source of the virtues of burned sponge, long of high repute in the treatment of goiter.

GO'ITO, a small t. in Lombardy, about 15 m. n.w. from Mantua, occupies a beautiful though somewhat marshy position on the Mincio. This town, owing to its vicinity to the stronghold of Mantua, has been the field of various military operations. In 1630, it was carried by assault by the imperialists, who entered Mantua on the same night, and took it by surprise; during the war of the Spanish succession in 1701, it was alternately captured by the allies and the imperialists; and in 1796 the French took it, but were expelled, after a brief tenure, by the Austrians. In 1814, a severe engagement took place at Goito between the Austrian and Italian troops; and during the war of independence in 1848, it became the theater of two further battles between the same powers, to which it owes its modern celebrity. Pop. 3,600.

GOLCON'DA, a fortress of the nizam, situated 7 m. to the n.w. of his capital, Hyderabad, stands in lat. 17° 22′ n., and in long. 78° 25′ east. In its immediate neighborhood are the ruins of an ancient city, once the metropolis of the kingdom of Golconda. The place itself is still strong; but its strength is seriously impaired through its being overtopped, within breaching-range, by the yet solid mausolea of its former sovereigns, which form a vast group at a distance of 600 yards. These tombs are dome-crowned structures of gray granite, each having its own mosque, and occupying the center of its own elevated terrace. Golconda is proverbially famous for its diamonds; but, in truth, they are merely cut and polished here, being generally found at Parteall, near the southern frontier of the nizam's dominions.

GOLD (symbol Au, atomic weight 196) has been known and regarded as the most precious of the metals from the earliest ages of the world, and has been universally employed as a medium of exchange. Although the quantity of gold which is found, when compared with that of many other metals, is small, yet there are few parts of the globe in which it does not occur more or less abundantly.

In the native state, it occurs crystallized, the primary form being the cube, or in plates, ramifications, or nodules—popularly known as *nuggets*—which sometimes are of very considerable size. It is almost always alloyed with silver, and sometimes with tellurium, bismuth, lead, etc. It sometimes occurs in small quantity in metallic sulphides, as in galena, iron, and copper pyrites.

The extraction of gold from the substances with which it is associated is effected more by mechanical than by chemical means. See below.

The following are its most important properties. In its compact state, it possesses a characteristic yellow color and high metallic luster, is nearly as soft as lead, and is the most malleable of all metals. It can be beaten into leaves of a thinness not exceeding $\frac{1}{200000}$, or, according to some authors, $\frac{1}{280000}$ of an inch, through which light passes with a green tint; one grain may thus be distributed over 56 sq. in. of surface; and the ductility of the metal is so great, that the same quantity may be drawn out into 500 ft. of wire. In its tenacity, it is inferior to iron, platinum, copper, and

silver; but a wire whose diameter is 0.787 (or rather more than one-third) of a line (which is one-twelfth of an inch), will support a weight of about 150 pounds. It fuses at about 2016°, according to Daniell's pyrometer, and when in fusion, is of a bluish-green color. It is scarcely at all volatile in the heat of the furnace, but by a powerful electric discharge, by the concentration of the sun's rays by a powerful burning-glass, or by the oxy-hydrogen jet, it is dispersed in purple vapors. Gold has very little affinity for oxygen; it undergoes no change on exposure to the atmosphere, and is unaffected by hydrochloric, sulphuric, or nitric acid, or, in short, by any simple acid except selenic acid; nor do the alkalies affect it. It is, however, dissolved by any mixture which liberates chlorine, its usual solvent being *aqua regia*, which is generally prepared by mixing 1 part of nitric acid with 4 parts of hydrochloric acid. Hydrochloric acid, to which binoxide of manganese has been added, acts equally well, the gold in these cases being converted into a chloride. This metal is one of the most perfect conductors both of heat and of electricity. When precipitated in a finely comminuted state, it is of a brown color; but when suspended in water, and viewed by transmitted light, it appears purple. The specific gravity of this metal is less than that of platinum and iridium, ranging from 19.2 to 19.4, according as it is fused or hammered.

The alloys of gold, or its combinations with other metals, are very numerous, those with copper and mercury being the most important. Copper and gold combine in all proportions without materially affecting the color of the latter, except that it is somewhat redder. The density of the compound is less than that of gold, but the hardness is greater, and it is more fusible. It is this alloy which is employed in our gold coinage, 11 parts of gold, being combined with one of copper, without which the coin would not be sufficiently hard to stand the wear to which it is exposed. Hence, British standard gold contains 8.33 per cent, of copper. In France, and in the United States, standard gold contains 10 per cent. of the latter metal. Jewelers alloy their gold with other metals, partly on economical grounds, and partly for the purpose of evolving special tints. Thus, red gold is obtained by combining 75 parts of fine gold with 25 of copper; green gold, by combining 75 parts of fine gold with 25 of silver; dead-leaf gold, by combining 70 parts of fine gold with 30 of silver; water-green gold, by combining 60 parts of fine gold with 40 of silver; blue gold, by combining 75 parts of fine gold with 25 of iron.

Mercury and gold combine very readily, and yield a white alloy, termed an *amalgam*, which is used in gilding. In consequence of the readiness with which these metals unite even at ordinary temperatures, mercury is used for the extraction of gold.

As a general rule, the ductility of gold is much impaired by alloying other metals with it, while its hardness and sonorousness are increased.

Two oxides of gold are known—a protoxide, AuO, and a teroxide, AuO_3. Neither of these oxides can be formed by the direct union of the elements, and both of them are reduced by heat. The protoxide is a dark-green or bluish-violet powder. It forms no definite salts. It is obtained by the decomposition of protochloride of gold with a solution of potash. The teroxide is a brown powder, which is reduced, not only by heat and light, but by many other reducing agents. It combines more readily with bases than with acids, and hence has been termed *auric acid*. We obtain it by mixing a solution of terchloride of gold with magnesia or carbonate of soda, and boiling.

Two chlorides of gold are known, corresponding to the oxides, viz., a protochloride, AuCl, and a terchloride, $AuCl_3$. Of these, the latter is the most important· it is obtained by dissolving gold in aqua regia, and evaporating the solution to dryness, at a temperature not exceeding 300°, when we obtain this compound, as a deliquescent yellowish brown or reddish mass, which is soluble in water, alcohol, and ether, with which it forms orange-colored solutions.

The chlorides of many of the organic bases form crystallizable double salts with the terchloride of gold, and these compounds are often employed to determine the combining power of the organic alkali.

Metallic gold in the form of a brown powder is thrown down from the solution of the terchloride by most reducing agents. This reducing power of protosulphate of iron is employed in the preparation of chemically pure gold.

A bisulphide of gold is obtained in the form of a black powder by passing a current of sulphureted hydrogen through a cold solution of terchloride of gold. "If finely divided gold be heated with sulphur in contact with carbonate of potash, a double sulphide of gold and potassium is formed: it resists a red heat, and is very soluble in water; this sulphur salt is used for gilding china, and produces the color known as *Burgos luster*."—Miller's "Elements of Chemistry," 2d ed., vol. ii. p. 74.

Fulminating gold, a compound known to the alchemists, who (Basil Valentine, for example) formed solutions of terchloride of gold, occurs as a green powder, when prepared by immersing teroxide of gold (or auric acid) in caustic ammonia. By modifying the mode of preparation, we obtain it of a brownish-yellow color. From Duma's analysis of the green powder, it seems to be represented by the formula $2NH_3.AuO_3$, the brownish-yellowish powder having a more complicated formula. These powders detonate when rubbed, struck, or beaten, or when an electric spark is passed through them, with a loud sharp report and a faint light, and they yield nitrogen gas, ammonia, and water. None but professed chemists should attempt to prepare them, in consequence

of their dangerous explosive character. On one occasion, a drahm of fulminating gold introduced into a bottle burst it as the stopper was being turned round, in consequence of small particles of it having adhered about the mouth, and both the operator's eyes were destroyed by the projected fragments of glass.

The *Purple of Cassius* is an important gold compound. It derives its name from its having been first described by Andreas Cassius in 1685. See CASSIUS, PURPLE OF.

None of the salts of the oxides of gold are of sufficient importance to require notice in this article.

For the description of *Mosaic Gold*, see TIN.

GOLD was, in all probability, one of the earliest discovered of the metals. The fact of its being found very generally distributed over the surface of the earth, and that, too, in its simple metallic state, combined with its beautiful color, and many valuable properties, would cause it very early to attract the attention of man. Accordingly, we learn that gold was used by the Hebrews, the Egyptians, and other ancient nations, for much the same purposes as it is at the present day.

Previous to the great Californian discovery in 1847, Europe was to a great extent supplied with gold from Mexico, Brazil, New Granada, Chili, and Peru in North and South America; a large quantity was also obtained from Asiatic Russia and the islands of the Indian Archipelago; the east and west coast of Africa furnished a less but still considerable quantity. All these countries still produce gold, but their total yield, including Europe, is only about one-fourth that of California and Australia.

The most famous mines in Europe are those of Hungary and Transylvania, which produce annually about £300,000 worth of this metal. Piedmont and Spain are almost the only other European countries where gold is worked; but it is occasionally found in all districts where the rivers flow over primary rocks.

Gold has been found in several parts of the British islands. The most productive district yet discovered was that of Wicklow, in Ireland, where towards the close of the last c., the stream-works were prosecuted for some time with considerable success. In Scotland, the Leadhills, on the borders of Dumfriesshire, as well as the highlands of Perthshire, and recently Helmsdale, in Sutherlandshire, have produced gold; so also have Cornwall and Devonshire in England, and in recent years a considerable quantity has been obtained from North Wales.

First among the celebrated gold discoveries of this c., in point of date, though not in importance, come those of eastern and western Siberia, where extensive auriferous tracts were discovered between 1829 and 1838. The quantity obtained in these eastern regions raised the annual produce of the Russian empire to three, and ultimately to four millions sterling—more than triple its former yield. Concerning Russia, it may be well to remark that an examination of the auriferous deposits of the Ural mountains led sir Roderick Murchison, in 1844, on comparing their rocks with those brought home by count Strzelecki from Australia, to predict the presence of gold on the latter continent. Subsequent discoveries, as is well known, have proved the accuracy of this conclusion in a very remarkable degree.

The rich gold region of California was discovered in Sept., 1847. Mr. Marshall, the contractor for a saw-mill on the estate of capt. Suter—a Swiss emigrant, settled on the banks of the Sacramento river—detected particles of gold in the sand of the mill-race, and on further examination, it was found that valuable deposits existed throughout the bed of the stream. Intelligence of the discovery soon reached the town of San Francisco, whose scanty population at once abandoned their usual occupations to join in the exciting search for gold. The supply was soon found to be abundant over a large area, and emigrants quickly poured in from all parts of the American continent, and erelong from Britain, Germany, and other European countries, till the population of San Francisco alone rose from under 200 in 1845 to 40,000 in 1858, and in 1870 it was 150,000 (see SAN FRANCISCO). At first, it was thought that the supply of gold from this region would soon fail, but though the supply, which continued for several years at upwards of £13,000,000 per annum, had in 1878 fallen to little over three millions from California, the total production of gold in the United States in that year was £9,455,000—almost wholly from the states near to or west of the Rocky mountains.

In 1851, before the excitement of the California discovery had time to subside, the world was startled by the announcement of another, or rather by a series of others, of not less importance, in Australia. It is a curious fact that not only sir R. Murchison, as stated above, but also the Rev. W. B. Clarke, a native geologist, had pointed out the likelihood of gold being found in the eastern chain of the Australian mountains, several years before the value of the gold-fields near Bathurst was discovered by Mr. Hargraves in April, 1851. This discovery was no sooner made, however, than several other places in Bathurst and the adjoining counties were found to contain rich deposits; so that, before many months had passed, 6,000 persons were employed at these *diggings*. In Aug., of the same year, further discoveries of gold were made at Ballarat, in Victoria, which excelled in richness those of the Sydney district; and these, in turn, were soon surpassed by fresh discoveries in the mount Alexander range. During the climax of the excitement created by the Victoria gold-fields, the number of diggers rose to such a pitch as to withdraw for a time the great mass of the population from Melbourne and Geelong.

The modes of working adopted at the first start of the diggings were necessarily rude and wasteful; the fortunes of the gold-seekers, too, were of course very variable under such a system, many of them having made large profits—as much, in a few instances, as a thousand pounds and upwards in a single week—but many more met with nothing but disappointment. A more systematic plan of mining, however, has now been introduced, by which the auriferous deposits are more completely worked out, and mining undertakings rendered less precarious. But notwithstanding the improved methods of working, the average annual produce of gold in the Australian colonies for the five years ending 1874, was only about £7,000,000, which was less than two-thirds of the yield of some earlier years. In the international exhibition of 1862 there was a gilded pyramid 10 ft. square at the base and 45 ft. high, representing the mass of gold exported from Victoria between Oct. 1, 1851 and Oct. 1, 1861. Its weight in solid gold would have been 26,162,432 ounces troy, which, taken roundly at £4 per ounce, gives its value as £104,649,728. The produce of California since the discovery of its gold-fields in 1847, up to the present time, may be estimated at about 50,000,000 ounces, and its value at £200,000,000.

Since the two great gold regions of California and Australia became known, three new ones of considerable promise have been discovered—one of them in British Columbia, the value of which was proved in 1858, although previously it was to some extent known to the Hudson's Bay Company; another is being successfully developed in Nova Scotia; and a third in the province of Otago, in New Zealand. It would appear that there is a great similarity between the general rock systems and auriferous deposits of this region and those of Australia. Before passing from the subject of recent gold-fields, it is worth noting that, a few years ago, Dr. Livingstone, the African traveler, discovered gold near Tete on the Zambesi—a district which may be found to be rich in the precious metal, when more deliberately surveyed. Its position is remarkable as occurring in the center of a coal-field.

The annual produce of gold in the whole world at the present time is somewhere between 30 and 40 millions sterling. Wherever gold is found, its origin can generally be traced to quartz veins in the primary or volcanic rock, such as granite, gneiss, porphyry, clay-slate, or greenstone. As these rocks became decomposed by the action of the weather, portions of the auriferous veins were carried down by streams and floods, and so found their way into the deposits of sand, clay, and shingle in river-beds, and in the gullies and flats of hills. Many auriferous drifts are of great thickness, formed by long-continued wasting of the rocks of neighboring hills, and therefore require mining to a considerable depth. Gold for the most part is found in small grains, or scales, called gold-dust; some of it, however, in pieces, or *nuggets* of considerable size. One found at Ballarat in 1858, called "the welcome," weighed 2,166 oz., and its value was £8,376 10*s.* 10*d.* Another discovered in Donolly district, Australia, in 1869, weighed 2,520 oz., and its value was £9,600. A good deal of the Mexican and European gold is obtained from auriferous pyrites.

Nearly all the metals except gold are most usually found as ores chemically combined with oxygen, sulphur, or other substances; and they therefore require to be separated by chemical processes. Gold ores, if we may use the term, require to be mechanically treated by the processes of crushing, stamping, and washing; the amalgamation process being resorted to when the gold occurs in a state of fine division.

One kind of crushing-mill consists of two large cast-iron rollers, which break the auriferous quartz into small pieces as it passes through between them. More usually now, a stamping-mill is used with iron-shod piles of wood, wrought by an axle with projecting cams after the fashion of flint-mills and beetling-machines. The ore pounded by the stamps is next washed, and for doing this there is an almost endless number of contrivances. In one of the richest quartz districts of California, it is carried by a current of water over coarse woolen blankets laid on sloping boards. By this plan, the lighter particles of quartz are carried away, and the particles of gold become entangled in the fibers of the wool. The blankets are washed at intervals in a tank, where the gold and other matters caught on their surface accumulates. It is then ready for the amalgamation process.

The gold of auriferous drift is partly extracted by washing, but there still remain minute particles invisible to the naked eye mixed with the *gangue;* indeed, some auriferous soils contain all their gold in a state of extreme division. To recover the gold either from this or stamped quartz, an amalgam is made; that is, it is mixed with mercury, which has the power of seizing on and dissolving the gold particles, however minute. The mercury is afterwards distilled off in a retort, leaving the gold nearly pure. Gold has of late been profitably extracted from sulphureted ores by Plattner's process, which converts it into a liquid chloride, and the gold is then precipitated from the solution by metallic copper.

To give some idea of the quantity of gold used in the arts, of which very little can be recovered, it may be stated that in the United Kingdom some 30,000 oz. in the shape of leaf gold, 10,000 oz. in the electroplate and other processes of gilding metals, and about the same quantity in gilding and making colors in the pottery districts, are annually consumed.

The quantity of gold poured into England during recent years has been immense.

See Great Britain. What has become of it all is often matter of surprise. Much has been sent to the mint, and much sent to foreign countries for their gold coinage. In France, Germany, Belgium, Holland, and Italy, all large sums are now paid in gold, instead of silver as formerly. That the continued influx of gold is gradually heightening prices in the United Kingdom is sufficiently obvious. The current price of standard gold is about £3 17*s*. 6*d*.

GOLD (*ante*). In no part of the world is gold found more widely diffused or in greater abundance than in the United States. It is found chiefly in two great belts, one the Appalachian, on the Atlantic slope, the other on the Pacific coast. The first of these belts extends from Virginia in a south-westerly direction through North Carolina, South Carolina, and Georgia, becoming narrower as it reaches Alabama and Tennessee. The belt is not continuous for the whole distance, but broken at many points. It sometimes expands to a width of 75 m., but is generally much narrower. In North Carolina, whose gold production is larger than that of any other state on the Atlantic slope, the metal is found in two parallel lines, each crossing the state in a s.w. and n.e. direction at a considerable distance from the other. The belt is divided also in a similar way in Georgia. The Appalachian belt shows itself also to a comparatively slight extent in Maryland, Pennsylvania, and Vermont, but in these states the gold is not found in quantities sufficient to pay the cost of obtaining it. It was not until 1824 that native gold found its way to the United States mints. From that time the supply grew more and more abundant until in five or six years it exceeded that from foreign sources. Until 1827, the supply came mainly from North Carolina, but after that considerable quantities were mined in South Carolina, Georgia, and Virginia. In 1837, branch mints were established at Charlotte, N. C., and Dahlonega, Ga. They were suspended in the time of the rebellion, but that at Charlotte has been since revived as an assay office. The discovery of gold in California led to an abandonment of many of the southern mines. The amount of gold from those mines deposited in the mints and assay offices of the United States up to June 30, 1873, was $20,052,006. Of this amount $1,631,612 came from Virginia, $9,983,585 from North Carolina, $1,378,180 from South Carolina, $7,267,784 from Georgia, $79,018 from Tennessee, and $211,827 from Alabama. The deposits from the southern mines in 1873 amounted to $158,958. It was known from a very early period that there was gold in California, but it was not until after the territory was annexed to the United States that the vast extent and richness of the supply was discovered. Since that day the development of the mines has been very rapid. At first the mining implements and methods were of the rudest sort, but as new discoveries were made and experience gained, these rude appliances were superseded, until now the business is prosecuted by means which science dictates and approves. Machines have been invented for separating the gold from the rocks in which it is embedded and for nearly every other mining process, and the work is prosecuted with unremitted energy and skill. Discovery has followed discovery until all the states and territories on the Pacific slope are seen to be rich in the precious ore. New mining settlements are springing up on every hand, population is rapidly augmenting, capital flows in abundance to every favorable point; and there are besides a great many places, too remote as yet from railway communication, where the precious metal is known to exist in great abundance. As the country becomes filled with an enterprising, wide-awake population, the now inaccessible places will be opened up and developed. In short, the supply of gold w. of the Rocky mountains bids fair to hold out for ages to come, if it is not for ever inexhaustible. From 1848 to 1859, inclusive, the gold product of California is estimated at $1,136,800,000; from 1860 to 1869 at $299,800,000. During the latter period the product of the states and territories was $254,950,000. Mr. John J. Valentine, the agent of Wells, Fargo & Co., who is understood to be thoroughly informed upon the subject, estimated the yearly production of gold from the whole Pacific slope from 1870 to 1879 inclusive, as follows: 1870, $33,750,000; 1871, $34,398,000; 1872, $38,177,395; 1873, $39,206,558; 1874, $38,466,488; 1875, $39,968,194; 1876, $42,886,935; 1877, $44,880,223; 1878, $37,756,030; 1879, $33,000,000. Total, $382,309,823. This gives as the whole product of gold from the Pacific slope since the first discoveries in 1847, the sum of $2,073,859,823. Gold has also been discovered in Alaska, and it may not be long perhaps before a tide of emigration will set in that direction. The new discoveries of gold made in the last few years are chiefly in Colorado and Dakotah, and in Mono co., Cal.* The gold and silver in the world, exclusive of the unknown regions of the e., is believed to have been reduced, at the time of the discovery of America, to about $170,000,000. Humboldt estimates the amount brought into Europe from the new world from 1490 to 1500 at $260 000 annually. The importation was doubtless fully equal to this rate until 1521, when Mexico was conquered and a great increase at once began. The receipts of American gold in Europe for the first 300 years after Columbus's discovery are supposed to have been more than three times as great as those from other parts of the world. England long had a considerable supply from Wales. Hungary, Austria, and Russia contain extensive gold fields. The gold production of Italy and France is far less important. In China and Japan gold exists in great abundance in many localities, and the gold formations of eastern Siberia are very extensive. The annual gold production of Africa is

probably not less than $1,000,000 annually. Generally gold is found so mixed with rock and other substances that it can be detached only by severe labor, but it is occasionally found in nuggets of considerable size and in a nearly pure state. Some of the largest nuggets of which we have an account weighed from 37 to 233 lbs. Troy weight. During the last twenty-five years, considerable gold-mining has been conducted in Nova Scotia, the auriferous region being under the control of the queen, who is represented by the mining commissioner at Halifax, by whom it has been divided into mining districts. These districts are leased for 21 years, and a royalty is paid to the government on the gold extracted. There are 14 gold-mining districts, and the yield in 1876 was about 12,000 oz.

GOLD—EXTRACTION BY SODIUM AMALGAMS. Certain difficulties which attend the separation of gold by amalgamation—caused by the presence of other metals which frequently cover the gold with a film of tarnish, and prevent the complete action of the mercury upon it—have led to the employment of sodium amalgamated with mercury in various proportions. This amalgam also restores the usefulness of mercury which has become *floured* or *sickened*. The compositions have been made the subjects of two patents, one by Dr. Wurtz of New York in 1864, the other by Mr. Crookes of London in 1865. The use of these considerably increases the yield of the precious metal. Mr. Crookes has three preparations, A, B, and C, all of which contain 3 per cent of sodium. A consists of mercury and sodium only; B of 20 per cent of zinc in addition; and C has 10 per cent both of zinc and tin added. Wurtz recommends two kinds, one containing 2, and the other 4 per cent of sodium. Although the quantity of sodium amalgam added to the mercury employed in the amalgamation process, differs according to the nature of the gold ores, yet one per cent at a time is a very common proportion; but this charge requires to be repeated as the sodium becomes expended. At first, the proportion of sodium used in these amalgams was sometimes as high as 15 per cent; but it has been found by experience that those with less sodium give better results. When it happens that the "flouring" of the mercury is caused by the presence of sulphide of antimony in the gold ores, the sodium amalgam is found to do harm rather than good.

GOLDAU, formerly a small t. of Switzerland, in the canton of Schwyz, was situated in a valley between Mt. Rossberg on the n. and Mt. Rigi on the s., five m. n.w. of the t. of Schwyz, and is memorable for its destruction by one of the most stupendous and fatal landslips on record. The upper portion of the slope of the Rossberg, consisting of a layer of stone resting on light soil, had been loosened by continuous rains, which percolated under the rock, and in a measure washed the soil from beneath it. On Sept. 2, 1806, toward the evening, the outer layer of rock became completely detached, and rushed down the mountain in a south-western direction into the valley. In a few minutes not only Goldau but the neighboring villages of Busingen and Rothen were overwhelmed in destruction, a part of the lake of Lauwerz was filled up, and by the sudden overflowing of the water the land to the west of Seewen was devastated. Two churches, 111 dwelling-houses, 220 outhouses containing many cattle, and 400 men were buried in one moment. Only a few of the unhappy inhabitants who, at the moment of the landslip, were at some distance from the scene, were saved. A numerous company of travelers, who were on the point of commencing the ascent of Mt. Rigi, were overtaken on the bridge of Goldau by the landslip, and perished. The valley is now a wild rocky waste, but grass and moss are gradually creeping over and veiling its more rugged features. On a height in this valley through which the highway leads from Arth to Schwyz, a chapel has been erected. The village of *Neu-Goldau*, on the line of the Rigi railway, consists of but a few houses.

GOLD-BEATER'S SKIN, a delicate membrane prepared from the large intestine of the ox, and used as a dressing for slight wounds, as the fabric for court-plaster, etc., but chiefly by gold-beaters. See GOLD-BEATING. The outer or peritoneal membrane is used for this purpose. The intestine is first subjected to a partial putrefaction, by which the adhesion of the membranes is sufficiently diminished to enable them to be separated; the separated membrane is then further cleaned from the adhering muscular fibers, dried, beaten, and pressed between paper, besides being treated with alum, isinglass, and white of egg, the object of which is to obtain the pure continuous membrane free from grease and impurities, without allowing the putrefactive processes to weaken it. A packet of 900 pieces of skin, each four in. square, is worth £8. They may be beaten continuously for several months with a twelve-pound hammer without material injury. The intestines of 500 oxen are required to furnish the 900 leaves that form one packet, or *mold*, as it is technically called. The manufacture is an extremely offensive one. Chlorine has been introduced both as a disinfectant and to assist in the separation of the membrane.

GOLD-BEATING, the process by which gold is extended to thin leaves used for gilding. The gold used for this purpose is usually alloyed with silver or copper, according to the color required. See GOLD. For *deep gold*, an alloy containing about 1 part of copper to 20 of pure gold is used. As gold-leaf is not sold by weight, but by superficial measure, and as increasing the quantity of alloy diminishes the malleability, there is but little temptation to use the baser metals as an adulteration.

The gold is first cast into oblong ingots about $\frac{3}{4}$ths of an inch wide, and weighing two oz. The ingot is flattened out into a ribbon of about $\frac{1}{800}$th of an inch in thickness by passing it between polished steel rollers. This is annealed or softened by heat, and then cut into pieces of one inch square; 150 of these are placed between leaves of vellum, each piece of gold in the center of a square vellum leaf, another placed above, and so on till the pile of 150 is formed. This pile is inclosed in a double parchment case, and beaten with a 16-pound hammer. The elasticity of the packet considerably lightens the labor of beating, by causing the hammer to rebound with each blow.

The beating is continued until the inch-pieces are spread out to four-inch squares; they are then taken out, and cut into four pieces, and squares thus produced are now placed between *gold-beater's* skin instead of vellum, made into piles, and inclosed in a parchment case, and beaten as before, but with a light hammer. Another quartering and beating produces 2,400 leaves, having an area of about 190 times that of the ribbon, or a thickness of about $\frac{1}{300,000}$th of an inch. An oz. of gold is thus extended to a surface of about 100 square feet. A still greater degree of thinness may be obtained, but not profitably. After the last beating, the leaves are taken up with wood pincers, placed on a cushion, blown out flat, and their ragged edges cut away, by which they are reduced to squares of $3\frac{1}{4}$ inches. Twenty-five of these are placed between the leaves of a paper-book, previously rubbed with red chalk, to prevent adhesion of the gold, and are sold in this form.

Attempts have been made to apply machinery to gold-beating, but though very ingenious, their application is very limited; most of the gold-leaf is still beaten by hand.

GOLDBERG, a manufacturing t. of Prussia (of great antiquity), in the province of Silesia, is situated on an eminence on the banks of the Katzbach, 10 m. s.w. of Liegnitz. It owes its origin and name to the gold-mines, which were worked here from the earliest times. At the commencement of the 12th c., they are said to have yielded 150 lbs. of pure gold weekly. After the great victory won by the Mongol hordes near Liegnitz in 1241, in which 600 of the miners of Goldberg perished, the town was taken by the conquerors. It also suffered greatly during the thirty years' war, and in 1813 was the scene of two engagements, the first between the French and Russians, and the second between the French and Prussians. Between 1863 and 1874 Goldberg suffered repeatedly from destructive fires. The town is celebrated for its manufactures of broadcloth, hosiery, and gloves, and for its fruit. Pop. '75, 6,492.

GOLD COAST. See GUINEA.

GOLDEN, the seat of justice of Jefferson co., Col., on Clear creek and the Colorado Central railroad, 16 m. w. of Denver; pop. 587. The town has a number of manufactories.

GOLDEN AGE. In the mythologies of most peoples and religions, there exists a tradition of a better time, when the earth was the common property of man, and produced spontaneously all things necessary for an enjoyable existence. The land flowed with milk and honey, beasts of prey lived peaceably with other animals, and man had not yet by selfishness, pride, and other vices and passions, fallen from a state of innocence. At the foundation of this legend lies the deeply-rooted opinion, that the world has degenerated with the progress of civilization, and that mankind, while leading a simple, patriarchal life, was happier than at present. The Greeks and Romans placed this golden age under the rule of Saturn; and many of their poets—as, for example, Hesiod, in his *Works and Days*, Aratus, Ovid, and, above all, Virgil, in the first book of the *Georgics*—have turned this poetic *matériel* to admirable account, and defined the gradual decadence of the world, as the silver, the brass, and the iron ages, holding out at the same time the consolatory hope that the pristine state of things will one day return.

GOLDEN BEETLE, the name popularly given to many of a genus of coleopterous insects, *chrysomela*, and of a tribe or family, *chrysomelinæ* or *chrysomelidæ*, belonging to the tetramerous section of the order. The body is generally short and convex, the antennæ are simple and wide apart at the base; some of the species are destitute of wings. Many are distinguished by great splendor of color. None are of large size. The finest species are tropical, but some are found in Britain. Some of them, in the larva state, commit ravages on the produce of the field and garden.

GOLDEN BULL (Lat. *bulla aurea*, Ger. *goldene bulle*), was so called from the gold case in which the seal attached to it was inclosed. The imperial edict known in German history under this title, was issued by the emperor Charles IV., mainly for the purpose of settling the law of imperial elections. Up to this time much uncertainty had prevailed as to the rights of the electoral body, claims having frequently been made by several members of the lay electoral families, and divisions having repeatedly arisen from this uncertainty; the effect of such divisions being to throw the decision for the most part into the hands of the pope. In order to obviate these inconveniences, the golden bull defines that one member only of each electoral house shall have a vote—viz., the representative of that house in right of primogeniture, and in case of his being a minor, the eldest of his uncles paternal. On the great question as to the dependence of the imperial office on the pope, and as to the right of the pope to examine and approve

the imperial election, the golden bull is silent, although it declares the emperor competent to exercise jurisdiction in Germany from the moment of election. It invests the vicariate together with the government of the empire during the interregnum, in the elector Palatine, and the elector of Saxony; but it is remarkable that this only applies to Germany. On the vicariate of Italy, which was claimed by the popes, nothing is said. The golden bull also contains some provisions restraining the so-called *faustrecht* (literally, "fist-law"), or right of private redress. It was solemnly enacted in two successive diets at Nuremberg and Metz, in the year 1356, and original copies of it were furnished to each of the electors, and to the city of Frankfort. The electoral constitution, as settled by this bull, was maintained almost unaltered till the extinction of the empire.

In Hungarian history there is a constitutional edict called by the same name. It was issued by Andrew II. in the early part of the 13th century. Without entering into details, it will be enough to say that the golden bull of Andrew II. changed the government of Hungary from an absolutism to an aristocratic monarchy, and that it contained till recent times the charter of the liberties of Hungary, or perhaps of the privileges of the noble class. See Schmidt's *Geschichte der Deutschen*, iii. 638.

GOLDEN-CRESTED WREN, *Regulus aurocapillus*, a very beautiful bird of the family *sylviadæ*, the smallest of British birds. Its entire length is scarcely three inches and a half. Notwithstanding its English name, it is not really a wren, but this name continues in popular use rather than *regulus* and *kinglet*, which have been proposed instead. The golden-crested wren is greenish-yellow on the upper parts, the cheeks and throat grayish-white; the crown feathers elongated, and forming a bright yellow crest. In its habits, it is intermediate between the warblers and the tits. It particularly affects fir-woods. It is not uncommon in Britain, from the most southern to the most northern parts; but many come also from more northern countries to spend the winter, and it is on record that, in Oct., 1822, thousands were driven on the coast of Northumberland and Durham by a severe gale from the n.e. The nest of this bird is suspended from the outermost twigs of a branch of fir, some of them being interwoven with it.—Another species (*regulus ignicapillus*), with more vividly red crest, is sometimes found in Britain, and species are found in Asia and North America.

GOLDEN EAGLE, *Aquila Canadensis*, the typical eagle and imperial emblem of ancient Rome and Persia. It is generally of brown color, and about 8 ft. long.

GOLDEN-EYE. See GARROT.

GOLDEN-EYE FLY, *Hemerobius perla*, or *chrysopa perla*, a neuropterous insect, common in Britain; pale green, with long thread-like antennæ, long gauze-like wings, and brilliant golden eyes. Its flight is feeble. The length, from the tip of the antennæ to the tip of the wings, is almost an inch and a half, but the insect without wings and antennæ is not above one third of this length. The female attaches her eggs, in groups of 12 or 16, by long hair-like stalks, to leaves or twigs. They have been mistaken for fungi. The larvæ are ferocious-looking little creatures, rough with long hairs, to which particles of lichen or bark become attached; they are called *aphis-lions*, and are very useful by the destruction of aphides, on which they feed. The pupa is inclosed in a white silken cocoon, from which the fly is liberated by a lid.

GOLDEN FLEECE, in Greek tradition, the fleece of the ram chrysomallus, the recovery of which was the object of the argonautic expedition. See ARGONAUTS. The golden fleece has given its name to a celebrated order of knighthood, in Austria and Spain, founded by Philip III., duke of Burgundy and the Netherlands, at Bruges, on Jan. 10, 1429, on the occasion of his marriage with Isabella, daughter of king John I. of Portugal. This order was instituted for the protection of the church, and the fleece was probably assumed for its emblem, as much from being the material of the staple manufacture of the low countries, as from its connection with heroic times. The founder made himself grand-master of the order, a dignity appointed to descend to his successors: and the number of knights, at first limited to 24, was subsequently increased. After the death of Charles V., the Burgundo-Spanish line of the house of Austria remained in possession of the order; but at the close of the Spanish war of succession, the emperor, Charles VI., laid claim to it in the virtue of his possession of the Netherlands, and taking with him the archives of the order, celebrated its inauguration with great magnificence at Vienna in 1713. Philip V. of Spain contested the claim of Charles; and the dispute, several times renewed, was at last tacitly adjusted by the introduction of the order in both countries. The insignia are a golden fleece hanging from a gold and blue enameled flintstone emitting flames, and borne in its turn by a ray of fire. On the enameled obverse is inscribed *pretium laborum non vile*. The decoration was originally suspended from a chain of alternate firestones and rays, for which Charles V. allowed a red ribbon to be substituted, and the chain is now worn only by the grand-master. The Spanish decoration differs slightly from the Austrian. The costume consists of a long robe of deep-red velvet, lined with white taffetas, and a long mantle of purple velvet lined with white satin, and richly trimmed with embroidery containing firestones and steels emitting flames and sparks. On the hem, which is of white satin, is embroidered in gold, *je l'ay empris*. There is also a cap of purple velvet embroidered in gold, with a

hood, and the shoes and stockings are red. In Austria, the emperor may now create any number of knights of the golden fleece from the old nobility; if Protestants, the pope's consent is required. In Spain, princes, grandees, and personages of peculiar merit are alone eligible.

GOLDEN HORDE, a force of Tartars who invaded Kiev and Moscow, destroyed several other cities, and in 1241 massacred a Magyar army. Their first leader was the grandson of Ghenghis Khan.

GOLDEN LEGEND (Lat. *Aurea Legenda*), a celebrated collection of hagiology, which for a time enjoyed almost unexampled popularity, having passed through more than 100 editions, and translations into almost all the European languages. It is the work of James de Voragine, also written "Vragine" and "Varagine," who was born about the year 1230. He entered the Dominican order, and was elected, at a comparatively early age, provincial of the order in Lombardy in 1267. Towards the end of that c., he was elected archbishop of Genoa; and by his ability, his moderation, and his exemplary life, he played a most influential part in the public affairs of his time, being called more than once into the councils of the popes themselves, in affairs of difficulty. The Legenda consists of 177 sections, each of which is devoted to a particular saint or festival, selected according to the order of the calendar. In its execution, the work, as may well be supposed from its age, is far from critical, but it is deserving of study as a literary monument of the period, and as illustrating the religious habits and views of the Christians at that time. It presents a very different phase of the mediæval mind from that which is exhibited in the acute and severely philosophical lucubrations of the schools. A translation of the Golden Legend was made by William Caxton, for the earl of Arundel, and first published in 1483.

GOLDEN NUMBER for any year is the number of that year in the Metonic cycle (q.v.), and as this cycle embraces 19 years, the golden numbers range from 1 to 19. The cycle of Meton came into general use soon after its discovery, and the number of each year in the Metonic cycle was ordered to be engraved in letters of gold on pillars of marble; hence the origin of the name. Since the introduction of the Gregorian calendar, the point from which the golden numbers are reckoned is 1 B.C., as in that year the new moon fell on Jan. 1; and as by Meton's law the new moon falls on the same day (Jan. 1) every 19th year from that time, we obtain the following rule for finding the golden number for any particular year: "*Add* 1 *to the number of years, and divide by* 19, *the quotient gives the number of cycles and the remainder gives the golden number for that year; and if there be no remainder, then* 19 *is the golden number, and that year is the last of the cycle.*" The golden number is used for determining the Epact (q.v.), and the time for holding Easter (q.v.).

GOLDEN-ROD, *Solidago*, a genus of plants of the natural order *compositæ*, sub-order *corymbiferæ*, closely allied to *aster*, but distinguished by the single-rowed pappus and tapering—not compressed—fruit. The species are natives chiefly of temperate climates, and are most numerous in North America. A few are European; only one is British, the COMMON GOLDEN-ROD (*S. virgaurea*), a perennial plant of very variable size, as there is a small alpine variety (sometimes called *S. cambrica*) only a few inches high, whilst the common variety, found in woods and thickets in most parts of Britain, is from 1 to 4 ft. high. It has erect panicled crowded racemes of small yellow flowers. It is an ornamental plant, and is sometimes seen in gardens. It had at one time a great reputation as a vulnerary, whence the name solidago, it is said, from Lat. *solidare*, to unite. The leaves of this and a fragrant North American species, *S. odora*, have been used as a substitute for tea. They are mildly astringent and tonic.

GOLDEN ROSE, a rose formed of wrought gold, and blessed with much solemnity by the pope in person on Mid-lent Sunday, which is called, from the first word of the festival, "Lætare Sunday." The prayer of blessing contains a mystic allusion to our Lord as "the flower of the field and the lily of the valleys." The rose is anointed with balsam, fumigated with incense, sprinkled with musk, and is then left upon the altar until the conclusion of the mass. Formerly, in the solemn papal procession of the day, the pope carried it in his hand. It is usually presented to some Catholic prince, whom the pope desires especially to honor, with an appropriate form of words. The origin of the ceremony is uncertain, but the most probable opinion as to its date is that of Martêne and Du Cange, who fix it in the pontificate of Innocent IV. See Webster's *Kirchen Lexicon*, vol. ix. 397.

GOLDEN RULE, a process in arithmetic, so called from the universality of its application. See PROPORTION.

GOLD-EYE, *Hyodon*, a genus of malacopterous fishes, inhabiting the lakes and rivers of North America; the type of a family, *hyodontidæ*, of which other members are found in tropical America and in Borneo. They are small fishes, much compressed like herrings, feed on insects like trouts, and like them are often taken by anglers with artificial flies. They have the mouth abundantly armed with teeth, having teeth far back on the palate as well as on the tongues and jaws.

GOLDFINCH, *Fringilla carduelis*, or *carduelis elegans*, a pretty little bird of the family fringillidæ, a favorite cage-bird, on account of its soft and pleasing song, its intelligence,

its liveliness, and the attachment which it forms for those who feed and caress it. The genus *carduelis* is distinguished by a thick conical bill, without any bulging, attenuated and very sharp at the tip. There are two groups, and one British species of each—a group with gay plumage and more prolonged bill, of which the goldfinch is the British representative, and another with darker plumage and shorter bill, represented by the aberdevine (q.v.) or siskin. The goldfinch is about 5 in. in entire length; black, blood-red, yellow, and white are beautifully mingled in its plumage. The colors of the female are duller than those of the male. It is widely diffused throughout Europe, and is found in some parts of Asia. It is a common bird in Britain, more abundant in England than in Scotland, but somewhat local. It is to be seen in small flocks on open grounds, feeding on the seeds of thistles and other plants, and in the earlier parts of the season frequents gardens and orchards. Its nest is made in a tree, bush, or hedge, is remarkable for its extreme neatness, and is always lined with the finest downy material that can be procured. The eggs are four or five in number, bluish white, with a few spots and lines of pale purple and brown. The goldfinch is much employed by bird-catchers as a call-bird. It can be trained to the performance of many little tricks; that which, most of all, the trainers seem to prefer being the raising of water for itself as from a well, in a bucket the size of a thimble.—The AMERICAN GOLDFINCH (*F.* or *C. tristis*) is very similar to the European species, has very similar habits and song, and displays the same interesting liveliness and affectionateness in domestication. The nest is also of the same elegant structure. It is a common bird in most parts of North America.

GOLD-FISH, or GOLDEN CARP, *Cyprinus auratus*, a fish of the same genus with the carp, a native of China, but now domesticated and naturalized in many parts of the world. It is said to have been originally confined to a lake near the mountain Tsien-king, in the province of The-kiang, in China; but this statement is of questionable accuracy. It has been long common in many of the fresh waters of China, and was introduced into England about the end of the 17th or the beginning of the 18th century. On account of the brilliancy of its colors and the ease with which it is kept in glass globes or other vessels, in apartments, it soon became, and has continued to be, a general favorite. Its ordinary length is 5 or 6 in., but it has been known to reach a foot. When young, it is of a blackish color, but acquires its characteristic golden red as it advances to maturity, some individuals (*silver-fish*) becoming rather of a silvery hue. Monstrosities of various kinds are frequent, particularly in the fins and eyes. The gold-fish is now plentiful in some of the streams of southern Europe, from which it is imported into Britain; but it also breeds in ponds in Britain, particularly in those into which hot water is poured from steam-engines, which sometimes swarm with its fry. In confinement, it may be fed with worms, insects, crumbs of bread, yolks of eggs dried and powdered, etc. Frequent changing of the water is advantageous, not only because of its being more fresh and better aërated, but because of the animalcules thus supplied for food.

GOLDHILL, a t. in Storey co., Nev., on the Virginia and Truckee railroad, 1 m. s. of Virginia City, and nearly 1¼ m. above the level of the sea; pop. 4,311. Silver-mining is the chief business.

GOLDLACE, a fabric formed by weaving silken threads that have been previously gilded. The peculiarity of this manufacture consists in the gilding of the silk in such a manner that it shall retain sufficient flexibility for weaving. A deep yellow or orange colored silk is used for the purpose. The usual method of doing this, is by what is called "fiber plating." A rod of silver is gilded by simply pressing and burnishing leaves of gold upon it. This gilded silver is then drawn into very fine wire, so fine that one ounce of metal can be extended to the length of more than a mile. It is then flattened between polished steel rollers, and further extended so that a mile and a quarter weighs only one ounce; for the last drawing, the wire is passed through ruby dies. The film of gold upon this flattened wire is much thinner than beaten gold-leaf, and has frequently been quoted as an example of the divisibility of matter, as one inch of the highly gilded wire contains but the eighty-millionth part of an ounce of gold, or $\frac{1}{100}$ of an inch, which is a visible quantity exhibiting the color and luster of gold, contains but $\frac{1}{8000000000}$ of an ounce, or one ounce of gold covers more than 100 miles of wire. This flattened gilded wire is then wound over the silk, so as to inclose it completely, and produce an apparently golden thread.

Other means of directly gilding the thread have been tried, and for some purposes are successful, but none have yet been discovered which give the thread the same degree of luster as the above, which was first practiced in a ruder manner by the Hindus.

Mr. Hock's method of fiber gilding is to pass the silk through a mucilaginous solution and then receive it on a brass cylinder, over which it is closely rolled. Gold-leaf is then laid upon this coil of gummed silk and thus one side is coated. The other side is gilded by rolling it from the first on to a second cylinder in the opposite direction; thus the plain side falls outermost, and is then coated with gold-leaf as before. This is rather cheaper than the fiber-plated silk, and more flexible, but not so brilliant.

GOLD MINES. In England, the crown has *prima facie* the right to gold mines; but where the gold is found in other mines, the crown is entitled only to take the gold at a fixed price. In Scotland, by an ancient act of 1592, the owner of the ground can demand a feu thereof from the crown, on paying one-tenth of the produce.

GOLDO'NI, CARLO, the most celebrated writer of comedy among the Italians, was b. at Venice in 1707, and received his first education at Rome. His father originally intended him for an actor, and fitted up a private theater for his diversion at home, but the boy showed no aptitude for histrionic performances, and in consequence he was sent to Pavia to study for the church. Goldoni, however, was still less fitted for being an ecclesiastic than an actor, and was finally expelled from college for writing scurrilous satires. In 1731, after his father's death, he was received as advocate; but finding the legal profession by no means lucrative, he relinquished its practice, and set about composing comic almanacs, which became highly popular. Several of his minor comedies were represented about this time, and attracted much public favor by their novelty as well as their real merit. In 1736 he espoused the daughter of a notary of Genoa, and subsequently went to Bologna, where, having obtained an introduction to prince Lobkowitz, he was intrusted with the composition of an ode in honor of Maria Theresa, and with the organization of the theatrical entertainments of the Austrian army. We next hear of him at Florence, working assiduously at comedies, which were, however, but an earnest of his best pieces. On his return to Venice he made very lucrative arrangements with the manager of the theater of St. Luke, and after a visit to Rome passed into France, and was appointed Italian master to the royal children, which situation allowed him to devote himself tranquilly to his literary occupations. In Paris he produced one of his most admired comedies written in French, and entitled *Le Bourru bienfaisant* (The Benevolent Grumbler). It excited universal admiration, and drew forth a most eulogistic criticism from the pen of Voltaire. On the breaking out of the revolution, Goldoni lost his pension, and died (Jan., 1793) shortly before its restoration by decree of the convention. The greater part of it was allowed to his widow, who likewise received the arrears due from the time of its cessation. Goldoni has left 150 comedies of unequal merit. The larger part are inimitable representations of the events of daily life, under both their simplest and most complex aspects. One aim pervades steadily all Goldoni's compositions—the advancement and elevation of honorable sentiments and deeds, and the flagellation of the prevailing vices and follies of the day.

GOLD OF PLEASURE, *Camelina*, a genus of plants of the natural order *cruciferæ*, having an erect calyx, small bright yellow flowers, and inflated pear-shaped or wedge-shaped pouches. The species are few. The common gold of pleasure (*C. sativa*), (Fr *Cameline*, Ger. *Dotter*) is an annual plant 1½ to 3 ft. high, with terminal racemes and pear-shaped pouches; the leaves smooth, bright green, entire or slightly toothed, the middle stem-leaves arrow-shaped and embracing the stem. Notwithstanding its high sounding English name, the plant is of humble and homely appearance. It grows in fields and waste places in Europe and the n. of Asia; it is not regarded as a true native of Britain, although often found in fields, particularly of flax, its seed being very commonly mingled with flaxseed imported from the continent. In many parts of Germany, Belgium, and the south of Europe, it is extensively cultivated for the sake of the abundant oil contained in its seeds. The seeds and the oil-cake made from them are also used for feeding cattle, although inferior to linseed, and to the oil-cake obtained from linseed. The oil, although sweet and pure at first, is very apt to become rancid, and is less valued than that of rapeseed or colza; the seeds of gold of pleasure are often mixed with rape-seed for the production of oil. The value of the plant in agriculture depends much on its adaptation to poor sandy soils, although it prefers those of a better quality; and on the briefness of its period of vegetation, adapting it for being sown after another crop has failed, or for being plowed down as a green manure. The seed is sown either broadcast or in drills. The crop is cut or pulled when the pouches begin to turn yellow; but the readiness with which seed is scattered in the field, rendering the plant a weed for future years, is an objection to its cultivation. It is not much cultivated in any part of Britain. The stems are tough, fibrous, and durable, and are used for thatching and for making brooms; their fiber is even separated like that of flax, and made into very coarse cloth and packing-paper. The seeds are used for emollient poultices, which allay pain, particularly in cutaneous diseases.

GOLDSBOROUGH, LOUIS MALSHEORBES, 1805–77, b. D. C.; went into the navy, took part in the Mexican war; was superintendent of the naval academy; in 1861 commanded the Burnside expedition to North Carolina; rear-admiral in 1862, and afterwards in command of the Washington navy yard; retired in 1873.

GOLDSCHMIDT, HERMAN, 1802–66; a German painter and astronomer, was the son of a Jewish merchant, b. at Frankfort. He for ten years assisted his father in his business; but, his love for art having been awakened while journeying in Holland, he began the studying of painting at Munich under Cornelius and Schnorr, and in 1836 established himself at Paris, where he painted a number of pictures of more than average merit, among which may be mentioned the "Cumaean Sibyl," an "Offering to Venus," a "View of Rome," the "Death of Romeo and Juliet," and several Alpine

landscapes. In 1847 he began to devote his attention to astronomy; and from 1852 to 1861 he discovered fourteen asteroids between Mars and Jupiter on which account he received the grand astronomical prize from the academy of sciences. His observations of the protuberances on the sun, made during the total eclipse on July 10, 1860, are included in the work of Mädler on the eclipse, published in 1861.

GOLDSCHMIDT, MADAME (JENNY LIND), a celebrated Swedish singer, was b. at Stockholm, Oct. 6, 1821. She was of humble parentage, and her musical gifts were first noticed by an actress, by whose influence she was admitted, at the age of nine, into the Conservatory of Stockholm, where she received lessons of Crœlius and Berg. She sang before the court with success, and at the age of 16 appeared in the *rôle* of Agatha, in *Der Freischütz*. Four years later, she went to Paris, to receive lessons from Garcia. Her voice was now thought wanting in volume, and when she appeared at the Grand Opera two years later, her failure was so mortifying, that she is said to have resolved never again to sing in France. Returning to Stockholm, she was heard with enthusiasm in *Robert le Diable*, and at the instance of Meyerbeer was engaged at Berlin in 1845. After singing two years in Prussia, she visited Vienna, and other German cities, and made her *début* in London in 1847, with a very marked success. Her return to Stockholm was greeted with an ovation, and the tickets to the opera in which she appeared were sold at auction. She returned to London in 1849, and won an immense triumph. The royal family and court were present at nearly every representation, and the receipts were often over £2,000. The London season was followed by a concert tour in the provinces, with a similar success, and her great popularity was increased by the distribution of a large part of her receipts in charities. In 1850, she made an engagement with Mr. P. T. Barnum of New York, for a concert tour in America, extending through the United States, British provinces, Mexico, and the West Indies. The receipts of this well-managed tour were 610,000 dollars, of which Mademoiselle Lind received 302,000 dollars. While in America, she was married to M. Otto Goldschmidt, a native of Hamburg, who accompanied her as pianist. They returned to Europe in 1852, and resided at Dresden after she had visited Stockholm, and expended £40,000 in endowing schools in her native country. Since then Madame Goldschmidt has rarely sung at concerts. In 1874, M. and Madame Goldschmidt became leading professors at the Rhenish academy of music in Wiesbaden. Her voice is a contralto of moderate range, but much power and expression. Her kind manners and abundant charities contributed to her popularity and success.

GOLDSINNY, or GOLDFINNY, a name given to certain small species of *crenilabrus*, a genus of fishes of the wrasse family (*labridæ*). They are rare on the British coasts, but are more plentiful on those of the n. of Europe. They frequent rocky coasts, and are sometimes taken by anglers from the rocks. They receive their name from their prevalent yellow color. Like the wrasses, they have a very elongated dorsal fin.

GOLDSMITH, OLIVER, was b. in the village of Pallas, in the county of Longford, Ireland, Nov. 10, 1728. His father, the rev. Charles Goldsmith, a clergyman of the established church, held the living of Kilkenny west. At the age of six, Goldsmith was placed under the care of the village schoolmaster, when an attack of small-pox interrupted his studies. On his recovery, he attended school at various places. On June 11, 1745, he entered Trinity college, Dublin, as a sizar; the expense of his education being defrayed by his uncle, the rev. Thomas Contarine. At the university—where Burke was his contemporary—Goldsmith gave no evidence of the possession of talent, and becoming involved in some irregularity, quitted his studies in disgust. He lingered in Dublin till his funds were exhausted, then wandered on to Cork, where, he being in great distress, a handful of peas was given him by a girl at a wake, the flavor of which remained forever sweet in his memory. By his brother Henry, he was brought back to college, where, on Feb. 27, 1749, he received the degree of B.A. His uncle was now anxious that his nephew should enter the church; but when he appeared before the bishop, he was rejected. His kind-hearted relative then gave him £50, and sent him to Dublin to study law; but Goldsmith, being attracted to a gaming-table, risked his entire capital, and of course lost it. Another sum was then raised, and he proceeded to Edinburgh to study medicine, where he remained 18 months, but did not take a degree. He then proceeded to the continent, hovered about Leyden for some time, haunting the gaming-tables, but with indifferent success; and in Feb., 1755, he left that city to travel on foot through Europe, scantily provided as to purse and wardrobe, but rich in his kindly nature and his wonder-working flute.

After taking his degree of B.M. at Padua or Louvain, Goldsmith returned to England in Feb., 1756, when, by the assistance of Dr. Sleigh, a fellow-student, he set up as a physician among the poor. He did not succeed in his profession, and he is represented as having become usher in the academy of Dr. Milner at Peckham. During this period he supported himself by contributions to the *Monthly Review*. He became candidate for a medical appointment at Coromandel, but was rejected by the college of surgeons. The clothes in which he appeared for examination had been procured on the security of Mr. Griffiths, editor of the *Monthly Review;* and as Goldsmith, urged by sharp distress, had pawned them, his publisher threatened him with the terrors of a jail. He had now reached the lowest depths of misery; but the dawn was about to break.

His first publication of note was an *Inquiry into the Present State of Polite Learning in Europe*, and was published in April, 1759. In Jan., 1760, Mr. Newbery commenced the *Public Ledger*, to which Goldsmith contributed the celebrated *Chinese Letters*, afterwards republished under the title of *The Citizen of the World*. He also wrote a *Life of Beau Nash*, and a *History of England*, in a series of letters. On May 31, 1761, he was introduced by Dr. Percy to Dr. Johnson, who, in his turn, introduced his new friend to the literary club. In Dec., 1764, *The Traveller* appeared, and at once placed him in the front rank of English authors. Two years after this he published the *Vicar of Wakefield*, which has now charmed four generations. In rapid succession he produced his other works. The comedy of the *Good Natured Man*, in 1767; the *Roman History*, in 1768; and *The Deserted Village*—the sweetest of all his poems—in 1770. In 1773, his comedy of *She Stoops to Conquer* was produced at Covent Garden with great applause. His other works are—*Grecian History*, 1774; *Retaliation*, a poem, 1777; and *History of Animated Nature*, which he did not live to complete. Although now in receipt of large sums for his works, Goldsmith had not escaped from pecuniary embarrassment. He was extravagant, loved fine living and rich clothes, his charities were only bounded by his purse, and he haunted the gaming-table quite as frequently, and with as constant ill success, as of old. In Mar., 1774, he came up to London, ill in body and harassed in mind, and took to bed on the 25th. With characteristic willfulness and imprudence, he, contrary to the advice of his medical advisers, persisted in the use of James's powder. He became rapidly worse, and Dr. Turton said: "Your pulse is in greater disorder than it should be from the degree of fever you have. Is your mind at ease?" "No, it is not," was the poet's reply, and the last words he uttered. He died on April 4, £2,000 in debt, and more sincerely lamented than any literary man of his time. Old and infirm people sobbed on the stairs of his apartments, Johnson and Burke grieved, and Reynolds, when he heard the news, laid down his pencil, and left his studio. He was buried in Temple church, and a monument was erected to him in Westminster abbey, bearing an epitaph by Dr. Johnson.

Goldsmith was the most natural genius of his time. He did not possess Johnson's mass of intellect, nor Burke's passion and general force, but he wrote the finest poem, the most exquisite novel, and—with the exception perhaps of the *School for Scandal*—the most delightful comedy of the period. Blundering, impulsive, vain, and extravagant, clumsy in manner and undignified in presence, he was laughed at and ridiculed by his contemporaries; but with pen in hand, and in the solitude of his chamber, he was a match for any of them, and took the finest and kindliest revenges. Than his style—in which, after all, lay his strength—nothing could be more natural, simple, and graceful. It is full of the most exquisite expressions, and the most cunning turns. Whatever he said, he said in the most graceful way. When he wrote nonsense, he wrote it so exquisitely that it is better often than other people's sense. Johnson, who, although he laughed at, yet loved and understood him, criticised him admirably in the remark: "He is now writing a natural history, and will make it as agreeable as a Persian tale." The standard life of Goldsmith is by Forster (1854); the excellent little work on Goldsmith by William Black appeared in 1879.

GOLDSMITHS' COMPANY, one of the richest guilds in England, formed at first for the protection of gold and silver artifices, and now intrusted with the assaying and stamping of all standard gold. Antiquarians assert that the Goldsmiths' company must have been formed in the early Anglo-Saxon times. In the reign of Henry II. (1180) it is mentioned with other guilds as existing without license, and in 1236 was rendered notorious by a virulent quarrel with the merchant tailors, which was quelled only by the interference of the legal authorities. Fifteen charters have at different times been awarded to this guild, and in 1396 it was incorporated as a company, while the arms, crest, and supporters were added in 1571. Privileges have been constantly extended to it, and since the time of James I., when the last charter was granted, its wealth and importance have steadily increased. The company's buildings are situated in the rear of the general post-office. The site occupied belonged to a brother of the bishop of London in 1816, and was made over to the guild by him. It is uncertain when the buildings were commenced, but the first stone of the hall itself was laid by sir Brue Barentyn, 1407. During the great fire of London it sustained serious damage, but was repaired, and was completed in 1669. The charities in connection with it are large, and number over fifteen, its revenues are enormous, and increase yearly, while the value of the property owned by the company is incomputable.—Among many treasures left to it by will are the coronation cup used at queen Elizabeth's accession, and many rare and exquisite paintings, statures, etc. Hayter's portrait of queen Victoria is a late acquisition. The guild possesses the right of assaying all articles made of gold and silver, for which it receives from the manufacturers fees exceeding in value £6,000 per annum. In addition to this the government pays the company a large salary for collecting excise dues and paying them into the bank. The method of testing gold by assay is performed by scraping off a portion of the metal and subjecting it to an analytical test, and the article is stamped in accordance with the absolute quantity of pure metal which it contains. Assay marks are variously used. The Goldsmiths' company possesses five: the first, an impression of the sovereign's head, indicating the reign; the second, the lion

passant, which is the standard mark, and dates back to queen Elizabeth, or possibly to Henry VIII.; the price mark referable to the enactments of William III.; and the remaining two, a leopard's head, and the maker's mark, both of uncertain period. In addition to these assay marks, in order to stamp the date exactly and correctly, the company have introduced the "date" letter. Twenty letters of the alphabet are used for this purpose, the series commencing with the first, omitting Y and ending with U. The letter is changed yearly, and the shape of the letter every twenty years. Thus, from 1796 to 1816, the ordinary letters were in vogue, and the letter D would mean 1799, while, as the smaller letters came into use at the end of the twenty years, or 1816, a small D would give 1820 as the year of manufacture. Then, in the twenty years to 1856 old English capitals were employed, giving place in turn, at the expiration of that time, to small old letters. The earliest known letter date was used in 1438.

GOLDSMITHS' NOTES, the earliest form of bank-notes; so called because goldsmiths were the first bankers. See BANK-NOTES.

GOLD STICK, superior officers in the English body-guard, and captains in the corps of gentlemen-at-arms; so called because on state occasions they carry a gilded baton.

GOLF, or GOFF, a pastime almost peculiar to Scotland, derives its name from the club (Ger. *Kolbe*; Dutch, *Kolf*) with which it is played. It is uncertain when it was introduced into Scotland, but it appears to have been practiced by all classes to a considerable extent in the reign of king James I. Charles I. was much attached to the game, and on his visit to Scotland in 1641, was engaged in it on Leith Links when intimation was given him of the rebellion in Ireland, whereupon he threw down his club, and returned in great agitation to Holyrood house. The duke of York, afterwards James II., also delighted in the game; and prince Leopold, who not unfrequently plays, was elected captain of the St. Andrews royal club in 1876.

Until late years, golf was entirely confined to Scotland, where it still maintains its celebrity as a national recreation; but latterly it has been established south of the Tweed, as well as in many of the British colonies. It is played on what are called in Scotland *links* (Eng. *downs*), that is, tracts of sandy soil covered with short grass, which occur frequently along the east coast of Scotland. St. Andrews and Leven in Fife, Prestwick in Ayrshire, Musselburgh in Mid Lothian, North Berwick and Gullane in East Lothian, Carnoustie and Montrose in Forfarshire, and Aberdeen, are examples of admirably suited links, as the ground is diversified by knolls, sand-pits, and other *hazards* (as they are termed in golfing phraseology), the avoiding of which is one of the most important points of the game.

A series of small round holes, about four inches in diameter, and several inches in depth, are cut in the turf, at distances of from one to four or five hundred yards from each other, according to the nature of the ground, so as to form a circuit or *round*. The rival players are either two in number, which is the simplest arrangement, or four (two against two), in which case the two partners strike the ball on their side alternately. The balls, weighing about two ounces, are made of gutta-percha, and painted white so as to be readily seen.

An ordinary golf-club consists of two parts spliced together—namely, the shaft and head, the shaft is usually made of hickory, or lance-wood; the handle covered with leather: the head (heavily weighted with lead behind, and faced with horn) of well-seasoned apple-tree or beach. Every player has a *set* of clubs, differing in length and shape to suit the distance to be driven, and the position of the ball; for (except in striking off from a hole, when the ball may be *teed*—i. e., placed advantageously on a little heap of sand, called a *tee*) it is a rule that the ball must be struck as it happens to lie. Some positions of the ball require a club with an iron head. The usual complement of clubs is six; but those who refine on the gradation of implements use as many as ten, which are technically distinguished as the *play-club*, *long-spoon*, *mid-spoon*, *short-spoon*, *baffing-spoon*, *driving-putter*, *putter*, *sand-iron*, *cleek*, and *miblick* or *track-iron*—the last three have iron heads, the others are of wood. Every player is usually provided with an attendant, called a *caddy*, who carries his clubs and "tees" his balls.

The object of the game is, starting from the first hole, to drive the ball into the next hole with as few strokes as possible; and so on round the course. The player (or pair of players) whose ball is holed in the fewest strokes has gained that hole; and the *match* is usually decided by the greatest number of holes gained in one or more rounds; sometimes it is made to depend on the aggregate number of strokes taken to "hole" one or more rounds.

To play the game of golf well requires long practice, and very few attain to great excellence who have not played from their youth. But any one may in a year or two learn to play tolerably, so as to take great pleasure in the game; and for all who have once entered upon it, it possesses no ordinary fascination. It has this advantage over many other outdoor games, that it is suited both for old and young. The strong and energetic find scope for their energy in driving long balls (crack-players will drive a ball above 200 yards); but the more important points of the game—an exact eye, a steady and measured stroke for the short distances, and skill in avoiding hazards—are called forth in all cases. Along with the muscular exercise required by the actual play,

there is a mixture of walking which particularly suits those whose pursuits are sedentary —walking, too, on a breezy common, and under circumstances which make it far more beneficial than an ordinary "constitutional."

Golf associations are numerous in Scotland, and in many instances the members wear a uniform when playing. Many professional players make their livelihood by golf, and are always ready to instruct beginners in the art, or to play matches with amateurs. The rules laid down by the St. Andrews royal and ancient union club are those that govern nearly all the other associations, and may be found in *Chambers's Information for the People*, No. 94. See also *Golf, a Royal and Ancient Game*, by R. M. Clark (Edin. 1876).

GOLFO DULCE, in English, *sweet or fresh golf*, lies in the state of Guatemala, in Central America, measuring 26 m. by 11, and having an average depth of 6 or 8 fathoms. It communicates with the outer sea, here known as the gulf of Honduras, by a narrow strait called the Rio Dulce.

GOL'GOTHA, a Hebrew word signifying a "skull," and so it is interpreted by Luke; but by the other three evangelists, "the place of a skull." The Latin equivalent is *calvaria*, "a bare skull." This place, the scene of the crucifixion of Christ, was situated without the gates of Jerusalem, on the eastern side of the city, although the common opinion handed down from the middle ages fixes it in the n.w. (see CALVARY). It was probably the ordinary spot of execution, though this is to be inferred rather from the fact that, in the eyes of the Roman officers of justice, Christ was simply a common criminal, than from any supposed connection between the word "skull" and a place of execution; Golgotha receiving its name in all likelihood from its round skull-like form. A church was built over the spot in the 4th c. by Constantine. What is *now* called the "Church of the Holy Sepulcher" to *the n.w.* of Jerusalem, but within the walls of the city, has manifestly no claim whatever to be considered the building erected by Constantine; but while recent biblical scholars and travelers generally have assumed that the scene of our Savior's crucifixion and sepulture is not ascertainable, a writer in Smith's *Dictionary of the Bible* offers strong reasons for believing that the present mosque of Omar, called by the Mohammedans "The Dome of the Rock," occupies the site of the sacred Golgotha.

GOLIAD, a co. in s.w. Texas on the San Antonio river, intersected by the San Antonio and Gulf railroads; 900 sq.m.; pop. '70, 3,628—876 colored. The surface is level and the soil productive; the chief productions are corn and cotton. Co. seat, Goliad.

GOLI'ATH. See GATH.

GOLIATH BEETLE, *Goliathus*, a genus of tropical coleopterous insects, of the section *Pentamera*, and remarkable for the large size of some of the species, particularly the African ones. They are also, in respect of their colors, splendid insects. Little is known of their habits.

GOLIUS, JACOBUS, 1596–1667; a Dutch orientalist who studied at Leyden, where in Oriental languages he was the most distinguished pupil of Erpenius. In 1622, he accompanied the Dutch embassy to Morocco, and on his return he was chosen to succeed Erpenius. In the following year he set out on a Syrian and Arabian tour from which he did not return until 1629. The remainder of his life was spent at Leyden, where from that date he held the chair of mathematics, as well as that of Arabic, until his death.

GÖLL'NITZ, a small t. in the n. of Hungary, in the co. of Zips, is situated on the left bank of a river of the same name, a feeder of the Hernad, 17 m. s.w of Eperies. It has important iron and copper mines, and manufactures of wire and cutlery. Pop. '69, 5,205.

GOLL'NOW, a small manufacturing t. of Prussia, in the province of Pomerania, is situated on the right bank of the Ihna, 15 m. n.e. of Stettin. It was formerly a Hanse-town, and is surrounded by walls, and defended by two forts. The manufactures are woolen cloth, ribbons, paper, and tobacco; there are also copper-works. Pop. '75, 7,917.

GOLOMYN'KA, *Comephorus Baikalensis*, a remarkable fish, found only in lake Baikal, the only known species of its genus, which belongs to the goby family. It is about a foot long, is destitute of scales, and is very soft, its whole substance abounding in oil, which is obtained from it by pressure. It is never eaten.

GOLOSH'ES (formerly called galoshes), from *galoche*, a word through the French, from *galocha*, the Spanish for a patten, clog or wooden shoe. The French applied the term at first to shoes partly of leather and wood, the soles being wood, and the uppers of leather. The term was introduced to this country as a cordwainer's technicality, to signify a method of repairing old boots and shoes by putting a narrow strip of leather above the sole so as to surround the lower part of the upper leather. It was also adopted by the patten and clog makers to distinguish what were also called French clogs from ordinary clogs and pattens. Clogs were mere soles of wood with straps across the instep to keep them on; pattens were the same, with iron rings to raise them from the

ground; but the galoshes were wooden soles, usually with a joint at the part where the tread of the foot came, and with upper leathers like very low shoes.

By the term goloshes is now generally meant the India-rubber over-shoes which were introduced into Great Britain from America about the year 1847; but it was some time after this before the trade in them had reached much importance, as at first they were clumsily made, and of inferior quality. However, mainly by the exertions of the Hayward rubber company in America, their quality and appearance were soon much improved, and the demand for them increased rapidly. Many mills for their production were then started in America, and several were also set agoing in Great Britain, France, Germany, and Russia; but there are signs that the trade in these shoes is somewhat on the decline. In the populous districts of Great Britain, at all events, the demand for them now is not a fifth part of what it was 12 or 15 years ago. Their comparative cheapness however, still facilitates the sale of them in the outlying districts, and in poor countries generally.

As these shoes are at present made, they keep the stockings constantly damp, and the feet uncomfortable, by preventing the escape or the absorption of the perspiration. It is a little strange, too, that even when the uppers are almost entirely of some woven texture, and nothing but the sole of vulcanized rubber, they are not wholly free from this fault. Most kinds of rubber shoes have their separate pieces held together entirely by the adhesiveness of the rubber when treated by some solvent, such as turpentine. There are therefore no seams like those in the leather shoe, and this, taken along with the close texture of the rubber itself, is the cause of the discomfort we have mentioned. Still, when well made, they have several good qualities, such as their imperviousness to damp, as well as their softness, durability, and neatness. Leather shoes have become so costly, that one cannot but hope something will be done so to improve those made from this remarkable material, that they will at least retain their place as a partial substitute for leather ones.

The largest and best-conducted manufactory for the production of vulcanized rubber goloshes and other shoes in Great Britain, is that of the North British rubber Company at Edinburgh. Here the material is prepared by processes which are to some extent described under the head CAOUTCHOUC. That is, the rubber is (1) torn up into small pieces, washed, and rolled together in granulated sheets. (2.) It is then mixed, by the aid of heated rollers, with the vulcanizing materials, consisting of sulphur, litharge, lamp-black, pitch, resin, and sometimes other materials. (3). The final stage in the preparation of the material is done after the shoes are made, and consists in subjecting them for nine hours to a temperature of between 200° and 300° F. Rubber so treated is said to be vulcanized, for the properties of which see CAOUTCHOUC. After the rubber is thoroughly mixed with the materials we have mentioned, of which sulphur is the most essential, the so far prepared sheets of material are again rolled out between the heated rollers, till they are of the required thickness for the shoe uppers. For this purpose, the rollers, which are fitted into machines called calenders, are very carefully adjusted. The sheets for the soles are made in the same way; only, in their case, the rollers are so constructed as to produce a certain breadth for the heels of an extra thickness, and to indent the surface with grooves, to prevent slipping. Both soles and uppers for each shoe are cut out separately with a knife, since the material will not admit of a number of these being cut at a time by dies, which, however, is done in the case of the linings, as they are of cotton or wool, and will not stick together by pressure. Thin metal molds are used by the workmen for shaping the separate parts of a shoe—i.e., the rubber parts. The calico or other linings are coated round the edges with some strongly adhesive cement, probably dissolved rubber, and then all the pieces are ready to be put together.

Up to this stage, all the work has been done by men, but women actually make the shoes, a kind of work for which their nimble fingers are well suited. The lasts are of hollow cast-iron, and the company has no less than 170,000 pairs of them. Working with a number of lasts exactly the same, the girl first covers them with the various pieces of lining and insole, all of which are held together by the cement. Returning again to the first one, she now puts on the various outer pieces of the shoe, sticking them together quickly with a little turpentine at the junctions; and then by way of ornament, still more quickly runs a small notched wheel along where the seams in a leather shoe are, to finish her work. A clever girl will make fifty pairs a day; a very clever one, seventy. That is to make a pair of shoes in ten or twelve minutes. The next process is to coat the shoes with a varnish which gives them a beautiful gloss, and it is one of the great aims of the manufacturers to excel in this. Finally, they are put on light iron frames, and exposed to the heat of the vulcanizing chamber.

In the India-rubber works at Edinburgh, more than twenty distinct kinds of boots and shoes are made, and their average production is 4,000 pairs a day. Besides those worn in Great Britain, large numbers are exported to other countries, especially Germany, where, however, an inferior kind is largely made. For Norway and Sweden, a kind with warm felt lining has lately been much in demand.

GOLOVNIN, VASILY MIKHAILOVICH, 1776–1831; a Russian vice-admiral; educated in the Cronstadt naval school. From 1801 to 1806 he served as a volunteer in the

English navy. In 1807, he was commissioned by the Russian government to survey the coast of Kamtchatka and of Russian America, including also the Kurile islands. Golovnin sailed around the cape of Good Hope, and Oct. 5, 1809, arrived in Kamtchatka. In 1810, whilst attempting to survey the coast of the island of Kunashir, he was seized by the Japanese, and retained by them as a prisoner until Oct. 13, 1813, when he was liberated, and in the following year he returned to St. Petersburg. Soon after this the government planned another expedition, which had for its object the circumnavigation of the globe by a Russian ship, and Golovnin was appointed to the command. He started from St. Petersburg on Sept. 7, 1817, sailed round cape Horn, and arrived in Kamtchatka in the following May. He returned to Europe by way of the cape of Good Hope, and landed at St. Petersburg, Sept. 17, 1819.

GOLPE, in heraldry, a roundel purpure. It is sometimes called a *wound*. See ROUNDEL.

GOLTZ, BOGUMIL, 1801–70; a polish humorist and satirist. In 1847 he gave to the world the first fruits of his studies and reflections in the charming poetic *Buch der Kindheit*, in which he delineates the incidents and impressions of his own childhood with a tender feeling akin to that of Jean Paul. The dates which he gives in this narrative are inconsistent with those which he furnished for the memoir in Brockhaus's *Conversations-Lexikon*, and a chronological difficulty is thus created which perhaps it may not be possible to solve. The *Buch der Kindheit* was followed by a satirical and polemical epistle against Ronge and the friends of enlightenment, which he entitled *Deutsche Entartung in der lichtfreundlichen und modernen Lebensart*. For the purpose of enlarging his experience of men, and amassing stores of material for his art as humorist and reformer of human life and society, he undertook a course of extensive travels, visiting Germany, France, England, Italy, and Egypt. In 1850 he published *Das Menschendaseyn in seinen welteweigen Zügen und Zeichen*. This was followed by another poetically conceived work on his own early life, entitled *Ein Jugendleben: Biographisches Idyll aus Westpreussen*, and by *Ein Kleinstädter in Ægypten*. In his next work, *Der Mensch und die Leute*, he especially displays his peculiar powers in profound and acute sketches of various races of men. His *Die Deutschen*, consisting of a series of studies on the history and peculiarities of the genius of the Germans, appeared in 1860. His other works are *Zur Charakteristik und Naturgeschichte der Frauen*, *Typen der Gesellschaft*, *Die Bildung und die Gebildeten*, *Vorlesungen*, and *Die Weltklugheit und die Lebensweisheit mit ihren correspondirenden Studien*.

GOMARISTS, or CONTRA-REMONSTRANTS, the name by which the opponents of the doctrines of Arminius (q.v.), the founder of the Dutch remonstrants, were designated. The party received this appellation from its leader, Francis Gomar. This theologian was born at Bruges, Jan. 30, 1563, studied at the universities of Strasburg, Heidelberg, Oxford, and Cambridge, in the last-mentioned of which he took his degree of B.D., in 1584. In 1594, he was appointed professor of divinity at Leyden, and signalized himself by his vehement antipathy to the views of his colleague, Arminius. In the disputation between the Armenians and Calvinists, held at the Hague, in 1608, his zeal was very conspicuous; and at the synod of Dort, in 1618, he was mainly instrumental in securing the expulsion of the Arminians from the reformed church. He died at Gröningen, in 1641. An edition of his works was published at Amsterdam in 1645. Gomarists, though stiff and bigoted in the last degree, and more Calvinistic than Calvin himself, was a man of various and extensive learning.

GOMBROON', called also BENDER or BUNDER ABBAS, a t. and seaport of Persia, stands at the mouth of the Persian gulf, in the strait of Ormuz, and opposite the island of that name. Bender Abbas owed its name and importance to Shah Abbás, who, assisted by the English, drove the Portuguese in 1622, from Ormuz, or Hormuz, then a flourishing commercial town on the island of the same name, ruined the seaport, and transferred its commerce to Gombroon. For some time Gombroon prospered abundantly, French, Dutch, and English factories were erected here, and the population rose to about 30,000. A dispute among the natives, however, resulted in the destruction of the European factories and houses, and only the remains of these now exist. Trade then almost entirely forsook Gombroon; it is now inhabited by only about 4,000 Arabs under a sheikh, who is subject to the sultan of Muscat, in Arabia. The town is surrounded by a mud wall; its streets are narrow and dirty.

GOMER, the eldest son of Japhet, and an ally of Gog, has usually, since Calmet's time, been identified with those Cimmerii who, originally inhabiting the districts to the n.e. and n. of the Black sea and sea of Azof, at an early period began to penetrate as far as Asia Minor, and in the 7th c. B C. overran Lydia, though without leaving permanent traces of their presence. This identification, however, is to be met with in none of the older writers. Josephus understands the Galatians of northern Phrygia to be intended; and Gimmeri or Gamir, was in the language of the ancient Armenians, a usual designation for their neighbors the Cappadocians. It is not impossible that an intimate ethnological connection between the Cappadocians of Kephalion and the Cimmerians of Homer may ultimately be established; but meanwhile it is important to observe that the three sons of Gomer, as named in Gen. x. 2, admit of a tolerably

definite localization. Ashkenaz, who has sometimes been identified with the Germans, is almost certainly the same as the Ascanians, a very ancient tribe of northern Phrygia. Riphath has nothing to do with the Rhipæan mountains, with the Carpathians, or with Niphates, but, as Josephus has pointed out, is to be identified with Paphlagonia; as Bochart has shown, the name probably survives in the designation of a river in Bithynia, and in a district situated on the Thracian Bosphorus. Although Togarmah is by Josephus interpreted as equivalent to Phrygia, there is a considerable amount of ancient testimony in favor of its identification with Armenia. It is possible that the same root is actually at the basis of the two words; at all events the connection is assumed in the account which the Armenians themselves give of their legendary history.

GOME'RA, one of the Canary Islands (q.v.).

GOMEY, ESTEVAN, d. 1525; a Portuguese explorer who accompanied Magellan as pilot. He mutinied, and carrying the crew with him put the captain in irons, and returned to Spain in command of the ship. It is supposed that in 1524 he set sail from Corunna, Spain, to search for a western passage to the Spice islands; that he struck the American coast at the point known as New York bay; that he ascertained the course of the Hudson river, and continued his course as far n. as the coast of Maine.

GOMOR, a co. in n. Hungary; 547 sq.m.; pop. '69, 103,639. It has a mountainous surface, and is intersected by navigable rivers. The inhabitants occupy themselves in cattle herding, and mining. The largest town is Rosenau.

GOMOR'RAH. See SODOM AND GOMORRAH.

GOMU'TO, ARENG, or EJOO PALM (*Arenga saccharifera, Saguerus Rumphii*, or *Borassus gomutus*), an important palm which grows in Cochin China and in the interior of Java, Sumatra, Celebes, and Amboyna, on dry ground. The stem is 20 to 30 ft. high; the leaves 15 to 25 ft. long, pinnated. The flowers are in bunches 6 to 10 ft. long; the fruit is a yellowish-brown, three-seeded berry, of the size of a small apple, and extremely acrid. The stem, when young, is entirely covered with sheaths of fallen leaves, and black horse-hairlike fibers, which issue in great abundance from their margins; but as the tree increases in age, these drop off, leaving an elegant naked columnar stem. The strongest of the fibers, resembling porcupine quills in thickness, are used by the Malays as styles for writing on the leaves of other palms. But the finer fibers are by far the most valuable; they are well known in eastern commerce as Gomuto or Ejoo fiber, and are much used for making strong cordage, particularly for the cables and standing-rigging of ships, European as well as native. Want of pliancy renders them less fit for running-rigging, and for many other purposes. They need no preparation but spinning or twisting. No ropes of vegetable fiber are so imperishable, when often wet, as those made of Gomuto fiber. At the base of the leaves of the Gomuto palm there is a fine wooly material, called *bara*, much employed in calking ships and stuffing cushions. The saccharine sap, obtained in great abundance by cutting the spadices of the flowers, is a delicious beverage, and by fermentation yields an intoxicating wine (*neroo*), from which a spirituous liquor called *brum* is made. In Java a brown sugar, much used by the natives, is made by boiling the sap.

GONAI'VES, a seaport of Hayti, with an excellent harbor, stands on a bay of its own name which deeply indents the w. coast of the island. It is 65 m. to the n.w. of *Port Republicain*, formerly *Port au Prince*, the capital.

GONDA, a district of Oudh, lying between 26° 46′ and 27° 50′ n., and 81° 35′ and 82° 48′ e., bounded on the n. by the lower range of the Himalayas, on the e. by Basti district, on the s. by Fyzabad and Bara Banki, and on the w. by Bharaich, and having an area of 2,824 sq. miles. Gonda presents the aspect of a vast plain with very slight undulations, studded with groves of mango trees. The surface consists of a rich alluvial deposit which is naturally divided into three great belts known as the "tarái" or swampy tract, the "uparhár" or uplands, and the "tarhár" or wet lowlands, all three being marvelously fertile. Several rivers flow through the district, but only two, the Gogra and Rápti, are of any commercial importance, the first being navigable throughout the year, and the latter during the rainy season. The country is dotted over with small lakes, the water of which is largely used for irrigation. The country contains tigers, leopards, bears, wolves, and deer. Large game birds are plentiful.

GONDA, the chief town and administrative head-quarters of Gonda district, in 27° 8′ n., and 82° 1′ east. The site on which the town now stands was originally a jungle, in the center of which was a cattle fold (Gontha or Gothán), in which the cattle were inclosed at night as a protection against wild beasts, and from this the town derived its name. The place was formerly celebrated for the manufacture of shields; now it is neither of commercial nor religious importance. The town contains a civil station, dispensary, school, literary institute, court-house, and jail. Pop. 13,722.

GONDAR, a city of Abyssinia, capital of the kingdom of Gondar or Amhara, is situated in lat. 12° 36′ n., and long. 37° 29′ e., on an insulated hill at an elevation of 7,420 ft. above sea level, and is 30 m. distant from the northern shore of lake Dembea or Izana (see ABYSSINIA). Gondar is the seat of the archbishop of Abyssinia, and was formerly the residence of the emperor or *Negus*. At one time it had from 50 to 100

churches and about 50,000 inhabitants; its population numbers at present about 7,000 only, but the latest returns show 44 churches, with nearly 1200 priests, besides numerous monks and nuns. It is poorly and irregularly built, and resembles a wood rather than a city, on account of the number of trees surrounding the houses. The palace, a square stone structure flanked with towers, is the most important building. There are no shops or bazaars, all the articles for sale being exposed on mats in the market-place. Gondar has manufactures of fire-arms, sword-blades, knives, scissors, razors, shields, pottery, etc.; and a considerable transit trade between Massuah on the Red sea and the s. of Abyssinia, in slaves, musk, wax, ivory, coffee, honey, etc. The mean temperature of Gondar, as observed by Rüppell during the seven months from Oct. to April inclusive, was 69°, and the lowest temperature during that time was 53.09°. A great quantity of rain falls here. As late as the middle of the 18th c. Gondar was capital of Abyssinia.

GONDOKORO, a t. in the country of the Bari negroes, on the Upper Nile, in 4° 54′n.—31° 28′ east. It is a center of the ivory trade, and before its annexation to Egypt by sir Samuel Baker in 1871 was also a center of the east African slave trade. A Catholic mission was established here in 1849 under Dr. Knoblecher, but was discontinued in 1858 owing to the unhealthiness of the climate—sixteen out of twenty-four of the missionaries having succumbed to it during the short period of the existence of the mission.

GON'DOLA (Italian), a long narrow boat (averaging 30 ft. by 4) used chiefly on the canals of Venice. The prow and stern taper to a point, and curve out of the water to a height of at least 5 feet. In the center there is a curtained chamber for the occupants: the boat is propelled by means of oars or poles by one, two, or occasionally four men. The rowers stand as they row, and wear the livery of the family to which the gondola belongs.

The term gondola is also applied to passage-boats having 6 or 8 oars, used in other parts of Italy.

GONDS. a race dwelling in the uplands of the central provinces of India, or Gondwana. They are hardy and brave and enterprising, but not far advanced in civilization; have brown skins, and straight black hair. In stature they are much below the average, the greater portion of males seldom exceeding 5 ft. in height. From general appearance it is supposed they are related in some degree to the Dravidian races who dwell further south. According to the census of 1872, the Gonds in central India numbered 2,041,276. Some of them are employed in agriculture, but a large proportion maintain existence upon fruits and animals. They possess no written language; many of them can speak Hindustanee, but in ordinary parlance they use only their own dialect. They are pantheistic in religion. Wives are bought, and polygamy is tolerated, but little practiced. Every kind of labor except hunting is undertaken by the females, the men devoting themselves to the chase.

GONDWANA, the land of the Gonds, is a hilly tract of Hindustan, lying between 19° 50′ and 24° 30′. and in e. long. between 77° 38′ and 87° 20′. It occupies a somewhat central position, sending its drainage at once northward into the Jumna, eastward through the Mahanadi into the bay of Bengal, and westward through the Tapti and the Nerbudda into the Arabian Sea—the water-shed in some places attaining an elevation of 5,000 feet. So isolated a locality, besides being in itself unfavorable to civilization, is rendered still more so by the extreme barbarism of the inhabitants, who are regarded, with some appearance of probability, as the genuine aborigines of India. Certain it is, that the country has never really formed a part of any of the great empires in the east.

GON'FALON (Ital. *gonfalone*), an ensign or standard; in virtue of bearing which, the chief magistrates in many of the Italian cities were known as gonfaloniers.

GONG, an Indian instrument of percussion, made of a mixture of metals (78 to 80 parts of copper, and 22 to 20 parts of tin), and shaped into a basin-like form, flat and large, with a rim of a few inches deep. The sound of the gong is produced by striking it, while hung by the rim, with a wooden mallet, which puts the metal into an extraordinary state of vibration, and produces a loud piercing sound.

GONGORA, Luis Y. Argote, a Spanish poet, was b. at Cordova, July 11, 1561; studied law at the university of Salamanca, where he composed the greater part of his erotic poems, romances, and satires. At the age of 45, he took orders, and obtained a small prebend in the cathedral of Cordova. He was afterwards appointed chaplain to Philip III., and died in his native city, May 24, 1627. Gongora's poetic career divides itself into two periods. In his *first* or youthful period, he yielded himself up entirely to the natural tendencies of his genius, and to the spirit of the nation. His lyrics and romances of this period are in the old genuine Spanish style; and in regard to their caustic satire and burlesque wit, are among the most admirable specimens of the class of poems to which they belong. Gongora, however, wished to outdo all his predecessors, and to furnish something wholly new and unheard of; the result of which unfortunate ambition was the introduction of a new poetic phraseology, called the *estilo culto*, or the "cultivated style." From this point the *second* period in Gongora's literary career dates. To popularize the *estilo culto*, he wrote his *Polifemo*, *Soledades*, and the *Fables of Pyramus and Thisbe*, productions of the most pedantic and tasteless descrip-

tion, poor in invention and thought, but rich in high-sounding pompous phrases, and overloaded with absurd imagery, and mythological allusions, expressed in language of studied obscurity. In this way he became the founder of a new school, the *Gongoristas*, or *Cultoristas*, who even surpassed their master in the depravity of their literary tastes. The most complete edition of Gongora's works is that by Gonzalo de Florez y Córdoba (Mad. 1638). Some of his romances have been translated into German by J. G. Jacobi (Halle, 1767).

GONIATI'TES, a genus of fossil cephalopodous mollusca, belonging to the same family as the ammonites. The genus is characterized by the structure of the septa, which are lobed, but without lateral denticulations, as in ammonites; they consequently exhibit, in a section, a continuous undulating line. Some forms with slightly waved septa approach very near to the nautilus, from which, however, they are at once separated, by the position of the small and delicate siphuncle, which is on the dorsal or external side of the shell. The lines of growth on the external surface have a sigmoid direction. The siphonal portion is shorter than the sides, forming a sinus at the back, as in the nautilus. The last chamber, the one tenanted by the animal, occupies a whole whorl, and has besides a considerable lateral expansion. The shells are small, seldom exceeding six inches in diameter.

This genus is confined to the Palæozoic strata: upwards of 150 species have been described from the Devonian, Carboniferous, and Triassic measures.

GONID'IA (Gr. *gonē*, generation, and *eidos*, an appearance), small green bodies which in some cryptogamous plants serve the purpose of reproduction, but apparently after a manner analogous to that of bulbils in phanerogamous plants, rather than by true fructification. It is not, however, certain that the bodies called gonidia in different classes of cryptogamous plants are all of exactly the same nature. The gonidia of lichens (q.v.) are found in layers in the interior of the thallus. In some of the lowest vegetable organisms, as *desmidiaceæ*, the gonidia are formed by the *endochrome* or contents of the cell breaking up into granules, sometimes invested with cilia, and moving as zoospores, at first within the cavity of the cell in which they are formed and afterwards without it.

GONIOM'ETER, an instrument for measuring the angles of crystals. The simplest instrument is that invented by Carangeau, which consists of two brass rulers turning on a common center, between which the crystal is so placed that its faces coincide with the edges of the rulers, and the angle is measured on a graduated arc. For large crystals this is sufficiently accurate, but as many minerals are found crystallized only in small crystals, and as small crystals of any mineral are generally the most perfect, an instrument capable of measuring more exactly was required. The one generally in use is the reflecting goniometer invented by Wollaston, and improved by Neumann. This is a more complicated instrument, yet easy of application, and it will measure very small crystals with certainty to within a single minute (1'). The angle is measured by the reflection of the rays of light from the surface of the different faces of the crystal.

GONORRHE'A (*gonos*, progeny or seed, and *rheō*, I flow), a name originally applied almost indiscriminately to all discharges from the genital passages in both sexes, but especially in the male. In the course of usage, the term has been almost entirely restricted to the designation of one particular kind of discharge, which, from its connection with a contagious poison, was originally called, in strict nosological language, *gonorrhea virulenta*. This form of the disease is usually caused by the direct communication of sound persons with those already affected; and accordingly gonorrhea is one of the numerous penalties attending an indiscriminate and impure intercourse of the sexes. See SYPHILIS. Gonorrhea is a very acute and painful form of disease; it is liable, how ever, to leave its traces in the more chronic form of gleet, which may last for a considerable time, and may give rise to alarm from being mistaken for other disorders. A description of the symptoms and cure of gonorrhea would of course be out of place in a work like the present; but we may avail ourselves of this opportunity to warn the victims of gonorrhea, and the allied disorders, against consulting any but medical men of the highest standing, and of undoubted character. An unworthy class of practitioners exists, who live chiefly by inveigling and frightening the unwary, and who not unfrequently extort vast sums of money by threats of exposure of what is communicated to them in confidence. The advertisements of these men are an offense to decency, and should act as beacons to the public rather than as they are intended.

GONORRHE'A [from Supplement], described also as BLENNORRHAGIA by some writers, is the most common form of venereal disease. It has been known from very remote times; it is generally believed that the sanitary measures inculcated in the 15th chapter of Leviticus have reference to this disorder as occurring amongst the Jews; and it was described by the Greek and Roman physicians. It consists in an inflammation of the mucous membrane of some part of the generative organs, producing a mucopurulent or purulent discharge from the diseased surface. Hence its name of gonorrhea, which is formed on the erroneous supposition that the discharge consists of the spermatic fluid, is unsuitable, and the attempt to substitute blennorrhagia, which signifies "a flow of mucous matter," has been made. Although it is termed a venereal disease, it is

totally distinct from syphilis (q.v.) Although gonorrhea is, in the great majority of cases, the result of direct contagion from sexual intercourse with a person who is similarly affected, there is no doubt that a very similar urethral discharge may arise from constitutional and other causes irrespective of contagion, as in scrofulous, gouty, or rheumatic subjects. Moreover, it is certain that this disease in the male may proceed from intercourse with a woman in whom no morbid change of the mucous membrane can be detected by the speculum. Ricord, a French physician of great authority in this department of medicine, lays down the proposition that "gonorrhea often arises from intercourse with women who have not had the disease." Diday, another high authority, maintains "that from the very fact of a woman having a discharge, no matter what its origin, she is liable to give a discharge to a man." English surgeons are gradually taking a similar view, and admit that gonorrhea may be the product of other causes than a specific poison. The fact of the disease being usually caused by impure intercourse is proof of the presence and action of the poison, but it is no evidence of that poison being of a specific character; any poison capable of being generated by simple inflammation being probably sufficient to induce the disease.

Men are so much more liable to contract this disease than women, that we shall confine our remarks to gonorrhea in the male. The symptoms usually appear in from three to five days after exposure to contagion. The patient feels an itching or tingling sensation at the extremity of the urethral passage, whose orifice has an abnormally florid appearance, and is usually closed by a viscid, colorless secretion. This premonitory stage may last for a day or two, when there is a swelling of the parts, and a thick creamlike pus exudes from the urethra. The passage of the urine is accompanied by a smarting or scalding sensation, and takes place with considerable difficulty, in a contracted or twisted stream. At night, a painful condition of the parts, known as chordee, and due to spasm of the muscular fibers of the urethra, is apt to come on. This stage may last, with slight variations, for a space varying from one to three weeks, its length depending on the patient's mode of life, and the number of previous attacks, the first being always the worst, and each succeeding one being gradually milder. The disease having thus reached its height, gradually subsides; the various symptoms abate in severity, and after a period of uncertain length, the discharge either ceases or assumes an almost entirely mucous character. If it ceases, the patient may be regarded as cured; if the mucous discharge continue, it is known as *gleet;* and it is only to this condition that the term blennorrhagia is truly applicable. This gleet often remains, in defiance of all treatment, for months, and its presence often preys very unnecessarily upon the patient's mind, so as to derange his health, and to suggest unnecessary fears regarding the loss of his virile powers. It is from patients of this kind, who cannot be persuaded that the discharge is unaccompanied by any further mischief to themselves (further than possible annoyance arising from the fact that they should not marry so long as *any discharge* exists), and that it is sure in due time to cease, unless there is stricture or some other exciting cause, that advertising quacks draw their greatest profits.

There are considerable discrepancies of opinion amongst the highest medical authorities regarding the treatment of this disease. Various quack medicines, in the form of prophylactic washes, to be employed after exposure to possible contagion, are daily advertised in certain cheap and disreputable journals; but as Dr. Druitt somewhat quaintly but very truly remarks: "The only prophylactic to be relied on is chastity; next to this, soap and water, followed by an alum wash." To these directions he might have added, that the urine should be discharged as soon as possible afterwards, so as to wash out the urethral passage. If the patient apply for advice on the first suspicion of the disease, before any acute inflammatory symptoms have set in, and if he can devote his whole time to his cure, he should keep a constantly recumbent position, should live on a farinaceous diet, avoiding meat, wine, and beer, and the *abortive* treatment should be tried. This consists in the injection into the urethra, every four or six hours, by means of a glass syringe, of a solution of two grains of nitrate of silver in eight oz. of distilled water. By about the second day, the discharge will begin to lessen, and the use of the injection must be stopped; and if any tinge of blood has appeared in the discharge, the remedy must *at once* be discontinued. If the diminution extend in a few days to a total disappearance of the discharge, the patient is cured; if a slight discharge continue, a weak solution of sulphate of zinc (one gr to the oz.) may be injected two or three times daily for a few days. During this treatment, the bowels should be kept freely open by an antimonial saline mixture, and the patient should drink freely of barley-water, linseed-tea, and similar mucilaginous fluids. If this treatment be adopted at the very first, we can usually cut short, in a week, an affection that might possibly be troublesome for months; if it be tried after inflammation has fairly established, it is very apt to give rise to *stricture.* If a patient does not seek advice till the acute stage has set in, perfect rest in the recumbent position should be insisted on; but if, as is too often the case, the patient is unable to carry out this important regulation, all exercise must be avoided as far as possible, and the parts affected should be properly supported by a bandage, specially sold for that purpose, and termed a suspensory bandage. A very low, unstimulating diet must be insisted on, and all stimulating drinks strictly prohibited, while he should partake freely of mucilaginous diluents; and as a medicine, an alkaline saline diuretic should be prescribed, such as a combination of a scruple of acetate or bicarbonate of

potash, half a dram of tincture of henbane, and twenty minims of nitrous ether, with a little tartar emetic in urgent cases, administered in a small tumbler of water, containing a little gum in solution, or of barley-water, three times a day. As an outward local application, nothing is better or more soothing than water as hot as the patient can bear it. When, under these means, the scalding pain in micturition and the local swelling subside—but not till then—certain medicines which exert a special influence on inflamed mucous membranes—viz., copaiva and cubebs—should be administered. Copaiva may be administered in half-dram doses three or four times daily; and after a few days, the dose may be increased, if necessary, to double that amount. Under no conditions can it be made an agreeable medicine. Some practitioners combine it into an emulsion with yolk of egg, liquor potassæ, or gum-arabic; others recommend that it should be taken floating on a wine-glassful of water to which a little tincture of orange-peel has been added. If the gelatine capsules of copaiva can be depended on as being genuine, they afford an easy mode of taking this medicine. In whatever form it is taken, it is liable to produce an eruption of the skin, consisting of small red patches somewhat resembling nettle-rash. Although the rash is perfectly harmless, and speedily disappears on the discontinuance of the medicine, and the administration of one or two saline purgatives, it often causes great alarm to a patient who has not been duly warned of its possible occurrence. Cubebs is a less unpleasant medicine than copaiva. To be of service, at least a dram of the powder should be taken three times a day suspended in milk. A confection formed by mixing powdered cubebs with balsam of copaiva, which may be swallowed as a bolus with an envelope of moistened rice-paper, is an efficacious form of prescribing these medicines. In the third stage, when the urgent symptoms are abating, the patient should continue the use of copaiva and cubebs, and should begin to use injections, commencing with one composed of a scruple of bismuth and half a grain of acetate of morphia in an oz. of water containing sufficient mucilage to keep the bismuth in suspension, to be used thrice daily. After a few days it may be replaced by one of sulphate of zinc (one gr. to an oz. of water), which may be increased in strength if necessary. If a gleet remains, it must be treated with tonic medicine, especially tincture of iron, exercise in the open air, sea-bathing, good diet, etc.; and the under-side of the urethra may be painted with tincture of iodine, or in very obstinate cases, treated with a slip of blistering tissue. A well-marked case of gonorrhea, when left entirely to itself, rarely runs a shorter course than from three to four months. Various forms and complications of gonorrhea occur, into which it is unnecessary for us to enter in this work.

As has been mentioned in the article OPHTHALMIA, the purulent discharge of gonorrhea, if brought in contact with the conjunctiva, may occasion destructive disease of the eye. There is also a troublesome affection, accompanied by pain, swelling, and tenderness of the joints, with feverishness, which is apt to supervene towards the decline of the discharge, which is known as *gonorrheal rheumatism*.

From what has been stated regarding the so-called *abortive* treatment, it is obvious that, by applying for medical aid on the earliest suspicion of contagion, the patient may save himself from a long and troublesome disease, which, if neglected or badly treated, may give rise to a serious local affection—namely, stricture of the urethra. As patients with diseases of these organs are apt to entertain remarkable and altogether erroneous views as to their constitutions being irretrievably ruined, and to the possible outbreak of secondary and tertiary symptoms, it is the duty of the practitioner always to impress upon them that, as a general rule, gonorrhea is merely a local affection, and cannot give rise to any subsequent constitutional symptoms.

GONVILLE AND CAIUS COLLEGE, CAMBRIDGE, was originally founded in 1348 by Edmund Gonville, son of sir Nicholas Gonville, rector of Terrington, in Norfolk, and endowed for a master and three fellows. In 1353, William Bateman, bishop of Norwich, whom Gonville had appointed his executor, removed the college to its present site, and altered the name to the "Hall of the Annunciation of Blessed Mary the Virgin." In 1558, Dr. Caius obtained a royal charter, founding the college for the third time, and altering the name to that which it now bears. By statute, the college consists of a master, 30 fellows, and 36 scholars; but two fellowships have been added—one in 1865, another in 1870. There are also five college studentships in medicine, founded by Christopher Tancred, each of the annual value of £100.

GONZAGA, a t. in Italy, in the province of Mantua; pop. 17,526. Formerly it was a strong military post, but is chiefly known as the home of the famous Gonzaga family, who ruled in Mantua in the 14th and 15th centuries.

GONZAGA, HOUSE OF, a princely family of German origin, from which sprang a long line of sovereign dukes of Mantua and Montferrat. The sway of this race over Mantua extended over a period exceeding three centuries, and many of its members were magnificent promoters and cultivators of arts, science, and literature. Wielding originally in the state the vast civic influence which in so many instances we find exercised by families of weight in the history of Italy, the Gonzagas gradually monopolized all the chief posts of command, both civil and military; and finally, in 1432, were invested with the title and jurisdiction of hereditary marquises, and in 1530 with that of dukes or sovereigns of the state. After their elevation to ducal dignity, they continued to own the feudal

supremacy of the empire, and were the faithful champions of the imperial interests in their policy with other states. The house of Gonzaga, and that of the Visconti dukes of Milan, were perpetually at war. The most illustrious personages of this race were GIOVANNI FRANCESCO (1407–44), in whose favor Mantua was created a marquisate by the emperor Sigismund, in return for his services to the empire.—GIAN FRANCESCO (1484–1519), who defeated Charles VIII. of France at the battle of Fornovo, on the banks of the Taro, 1495, when Gonzaga left 3,500 troops on the field, and Charles was forced to a hasty retreat. Gonzaga also took part in the engagement of Atella, 1496, which led to the capitulation of the French forces. His son, FREDERICK II. (1519–40), in recognition of the services he rendered the imperial forces in their contest with France, was invested by the emperor Charles V. with the ducal dignity in 1530, and also obtained the marquisate of Montferrat in 1536. During the reign of this prince, the court of Mantua was one of the most magnificent and gay of Europe.—GUGLIELMO (1550–87), the son of Frederick, was humpbacked, but proved a wise and enlightened ruler; his secretary was Bernardo Tasso, father of the poet.—VINCENZO (1587–1612), son of the Guglielmo, was the warm friend and patron of Tasso, and succeeded in obtaining the poet's freedom, when he was confined as insane by the duke Alfonso d'Este.—Vincenzo was much esteemed for his piety, justice, and liberality. He was successively followed by his three sons, Francesco, Ferdinando, and Vincentio, who died without heirs, and thus the direct line of the ducal branch became extinct. A collateral branch in the person of Charles I., duke of Nevers, son of Ludovico, the brother of Guglielmo the humpbacked, claimed the duchy, which was contested by his cousin Cæsar, duke of Guastalla. This family feud led to a general war, in which France supported Nevers, and the empire claimed the right of adjudging Mantua, as an imperial fief, to a candidate of imperial election. Mantua in 1629 was stormed, sacked, and stripped of all its magnificent possessions, by the imperialists, and never regained its former splendor. Charles de Nevers submitted finally to the emperor, and was installed in the duchy. The artistic treasures collected for ages by the Gonzaga princes were scattered throughout Europe, and came into the possession of several of the reigning sovereigns. The successors of Charles were dissipated and silly, and the tenth and last duke of Mantua, Ferdinand-Charles, was the most contemptible and dissolute of all. As he had countenanced the French in the war of the succession, the emperor Joseph I. deprived him of his states, placing him under the ban of the empire. He died in exile in 1708, leaving no issue.

GONZAGA, THOMAS ANTONIO COSTA DE, 1744–1809; the "Portuguese Petrarch." Having completed his law studies at the university of Coimbra, which he attended from 1763 to 1768, Gonzaga in the latter year returned to Brazil, and after having acted for some years as local magistrate at Beja and elsewhere, he was appointed judge at Villa-Rica, in the province of Minas, where he highly distinguished himself by administrative ability and by the many excellences of his private character. Before this time he developed some talent for versification, and his literary tastes soon brought him into intimate association with Claudio Manoel, Alvarenga Peixoto, and other writers of the so-called Minas school; but the love which inspires the poet did not, in his own opinion at least, come upon him until he had made the acquaintance (about 1788) of D. Maria Joaquina Dorothea de Seixas, the *Marilia de Dirceu* to whom all his extant poems relate. He had just been nominated a member of the supreme court of Bahia, and was on the eve of his marriage, when discovery was made of the treasonable plot of Minas, and he was arrested on suspicion of having been implicated in it. On merely circumstantial evidence, and that of a very inconclusive kind, he was condemned, 1792, to banishment for life to Pedras de Angoche, a sentence which was afterwards commuted to one of ten years exile at Mozambique. Here he made some effort to practice as an advocate, but he never recovered from the depression with which his cruel lot had affected him. He was attacked by nervous fever which undermined his health, and after years of increasing melancholy, which occasionally alternated with fits of acute mania, he died.

GONZALES, a co. in s. Texas on the Guadulupe river, traversed by the Galveston, Harrisburgh and San Antonio railroad; 1050 sq.m.; pop. '70, 8,951—3,670 colored. It has an undulating surface and the soil is fertile. There are valuable deposits of coal and iron. Productions, corn, and cotton. Co. seat, Gonzales.

GONZALVO DI CORDOVA (G. Hernandez y Aguilar), a celebrated Spanish warrior, was b. at Montillo, near Cordova, in 1453. He served with great distinction first in the war with the Moors of Granada, and afterwards in the Portuguese campaign. At the close of the final contest with Granada, he concluded the negotiation with Boabdil (Abu Abdallah), king of the Moors, in such a masterly manner, that the rulers of Spain bestowed upon him a pension and a large estate in the conquered territory. He was next sent to the assistance of Ferdinand, king of Naples, against the French. In less than a year, Gonzalvo, with his limited resources, had conquered the greater part of the kingdom, and obtained the appellation of "El Gran Capitano." In conjunction with king Ferdinand, he succeeded in completely expelling the French from Italy; and in Aug., 1498, returned to Spain, having received in return for his valuable services an estate in the Abruzzi, with the title of duke of San Angelo. When the partition of the

kingdom of Naples was determined upon by a compact entered into at Granada, Nov. 11, 1500, Gonzalvo again set out for Italy, with a body of 4,800 men, and on the way took Zante and Zephalonia from the Turks, and restored them to the Venetians. He then landed in Sicily, occupied Naples and Calabria, and demanded from the French that, in compliance with the compact, they should yield up Capitanata and Basilicata. This demand being rejected, a war broke out between the two belligerent powers, which was waged with varied success. After the victory of Cerignola, in April, 1503, Gonzalvo took possession of Calabria, Abruzzo, Apulia, even the city of Naples itself, and then laid siege to Gaëta, but was forced to retreat before a superior force of the enemy. On Dec. 29 of the same year, however, he fell upon them unexpectedly near the Garigliano, and obtained a complete victory, Dec. 29, 1503. The French army was almost annihilated; the fortress of Gaëta fell; and the possession of Naples was secured to the Spaniards. King Ferdinand bestowed the duchy of Sesa upon the conqueror, and appointed him viceroy of Naples, with unlimited authority. His good-fortune, however, made him many powerful enemies; and Gonzalvo was recalled to Spain, where the king treated him with marked neglect. Gonzalvo now betook himself to his estates in Granada; but after the defeat of the new viceroy in Naples by Gaston de Foix, he was again appointed to the command of the Spanish-Italian army. Mental suffering, however, had undermined the old hero's health, and on Dec. 2, 1515, he died at Granada.

GOOCHLAND, a co. in central Virginia, on the James river; 275 sq.m.; pop. '70, 10,313—6,601 colored. Surface undulating, and soil tolerably fertile; chief productions, wheat, corn, oats, and tobacco. Co. seat, Goochland Court House.

GOOD, John Mason, a physician and author, was b. at Epping, in Essex, 1764, and died in London in 1827. He commenced practice as a surgeon in Sudbury in 1784, but meeting with little success, he removed to London in 1793, principally with the view of obtaining literary employment.

In addition to *The Book of Nature*, the work by which he is now chiefly known, and which only appeared shortly before his death, he published various poems, translations, and professional treatises. Of his original poems we need say nothing. Amongst his translations we may notice his *Song of Songs, or Sacred Idyls*, translated from the Hebrew, 1803; his translation of Lucretius, in verse, in 1805; of the book of Job, in 1812; of the book of Proverbs, in 1821; and of the book of Psalms, which was just completed at the time of his death. His chief professional work, his *Study of Medicine*, in four volumes, was published in 1822. It is a learned and amusing work, but by no means a trustworthy guide to the medical student. He likewise published, in conjunction with Olinthus Gregory and Bosworth, the *Pantologia, or Encyclopædia, comprising a General Dictionary of Arts, Sciences, and General Literature*, in 12 volumes, which were completed in 1813; and contributed largely to various periodicals. His friend, Dr. Olinthus Gregory, published a memoir of his life in 1828.

GOODALE, Elaine and Dora Read, daughters of Henry S. and Dora H. Read. The elder sister, Elaine, was born at "Sky Farm," on Mt. Washington, Berkshire co., Mass., 1863, and Dora Read at the same place, 1866. Both parents have contributed to leading magazines, and shown considerable literary ability. The remarkable precocity, however, displayed by their two daughters in their earliest poetical productions is an interesting problem for psychological speculation, and their artistic development will be watched with interest. At eight years of age, Elaine began the publication of a little paper, called *Sky Farm Life*, in which their poems appeared from month to month. In 1877, the parents consented to the publication of some of the verses in *St. Nicholas*. The sisters have since been frequent contributors to that magazine, the *Springfield Republican*, *Good Company*, and have had an occasional poem in *Scribner's Monthly*. Their poems have been published in three volumes—*Apple Blossoms*, with portraits of Elaine and Dora (1878); *In Berkshire with the Wild Flowers* (1879); and *All Round the Year* (1880).

GOODALL, Frederick, an eminent English artist, the son of Edward Goodall, an engraver of reputation, was b. in London, Sept. 17, 1822. His first oil-picture was entitled, "Finding the Dead Body of a Miner by Torchlight," for which the society of arts awarded him the large silver medal. During the summers of 1838–42, he visited Normandy and Brittany, and in 1839, when but 17 years of age, he exhibited his first picture at the royal academy, "French Soldiers Playing Cards in a Cabaret." His "Entering Church," as well as "The Return from a Christening," which received a prize of £50 from the British institution, and others of his early pictures, were purchased by Mr. Wells. "The Tired Soldier," exhibited in 1842, was purchased by Mr. Vernon, and is now in the Vernon gallery. Some of his French scenes are, "Veteran of the Old Guard Describing his Battles;" "La Fête du Mariage;" "The Wounded Soldier Returned to his Family;" "The Conscript." In 1844, he went for subjects to Ireland, and subsequently visited North Wales. Among his Irish scenes are, "Irish Courtship;" "The Irish Piper;" and the "Departure of the Emigrant Ship." "The Village Festival," one of the best of his English subjects, exhibited in 1847, was purchased by Mr. Vernon. His "Hunt the Slipper" (1849), "Raising the Maypole" (1851), "Arrest of a Peasant Loyalist—Brittany, 1793" (1855), "Cranmer at the Traitor's Gate" (1856), "Rising of the Nile," "Subsiding of the Nile," "An Intruder on the Bedouin's Pasture"

(1876), etc., have also added greatly to his reputation. He visited Egypt in 1858. In 1852, Goodall was elected an associate of the royal academy, and in 1863, a royal academician.

GOOD BEHAVIOR, a phrase rather popular than legal. It is used chiefly as synonymous with keeping the peace. Thus, if one person assaults another, or threatens or provokes him to a breach of the peace, the offense is punishable summarily by justices of the peace, who, besides inflicting a fine, may, and often do, bind over the offending party to keep the peace, and be of good behavior for a period of 6 or 12 months. The mode of doing this is by requiring the offending party to enter into his recognizances with or without sureties, which is, in fact, the giving a bond for a specified sum to the crown, and if it is broken, that is, if the recognizance is forfeited, then the party may be again punished.

GOOD-CONDUCT PAY is an addition made in the British army to the daily pay of corporals and private soldiers, in consideration of long service unaccompanied by bad behavior. The amount awarded at one time is 1d. a day, with one white chevron on the arm as a badge of distinction. Successive awards of good-conduct pay may raise the total grant to 6d. a day, with a corresponding number of stripes on the arm. It reckons, in part, towards increase of pension when the soldier quits the service.

In each regiment there is kept a "Regimental Defaulters' Book," in which the commanding officer is bound to enter the name of every soldier in the corps who shall have been convicted by court-martial of any offense, or who, in consequence of misconduct, shall be subjected to forfeiture of pay, either with or without imprisonment, or to any other punishment beyond seven days' confinement to barracks. No first or subsequent 1d. of good-conduct pay can be awarded to a soldier, unless two continuous years have elapsed without his name being thus recorded; and if he have the misfortune to come within the provisions of this black book while actually in receipt of good-conduct pay, he loses for each offense 1d. per diem, which can only be restored after one uninterrupted year of good service, during which his name has not been recorded in the defaulters' book. The loss of the 1d. is of course accompanied by the loss of the corresponding distinguishing mark or stripe.

The first 1d. is obtainable after two years' service, without the name once appearing in the defaulters' book; the second, after six years; the third, after 12 years; the fourth, after 18 years; the fifth, after 23 years; and the sixth, after 28 years; the service being only reckoned in any case from the age of 18, and two years of uninterrupted good conduct immediately before the time at which the award is granted being requisite in every instance. As an additional inducement to continuous good behavior, 14 uninterrupted years without an adverse entry entitles a soldier, after 16, 21, or 26 years' service, to the award for which he would only otherwise be eligible after 18, 23, or 28 years.

Non-commissioned officers do not receive good-conduct pay, an addition instead thereof of 2d. per diem having been made to their regular pay a few years since. A sum, however, not exceeding £4,900 a year is distributed among sergeants of long service and good conduct, in the way of annuities, not over £20 each. The annuity is receivable during active service, and also in conjunction with the pension on retirement.

In the Malta fencible artillery, good-conduct pay is allowed to native soldiers for similar periods of service, but to only half the above amount.

A considerable increase of the army causes a large decrease in the sum payable for good conduct pay, as the older soldiers become non-commissioned officers, and the ranks are swelled by young recruits, who have not yet had time to earn these extra rewards. The total charge in the army for good-conduct pay during the year 1876–77 was £150,000.

Good-conduct pay and badges are also awarded in the navy to seamen of exemplary conduct; but the periods for obtaining, and the rules under which it is granted and forfeited, so nearly resemble those in force for the army, that a separate description is unnecessary. The leading differences are, that the grant is limited to three badges, and 3d. a day; that petty officers continue to hold it; and that it is of no account in the pension given at the expiration of active service.

GOODELL, William, an American editor and philanthropist, b. near the close of the 18th c., d. in Janesville, Wis., in 1879. As a young man, living at the time in Providence, R. I., he took part in the discussion of the Missouri question in 1819–20, opposing the admission of the territory to the union as a slave state. At the beginning of the temperance movement in 1826–27, he became one of its earnest champions, and for several years edited the *Genius of Temperance*, and other periodicals of a similar character. He was one of the earliest to enlist in the anti-slavery movement, and the editor for a time of the *Emancipator*, the organ of the American anti-slavery society in New York. He subsequently conducted for several years the *Friend of Man*, the organ of the New York state anti-slavery society, in Utica. Later still he founded successively in New York *The Radical Abolitionist* and *The Principia*, which he devoted mainly to the task of demonstrating that slavery in the United States had no legal or constitutional basis, and that courts of justice were not only not bound to pay it any respect, but had the right in all cases where they had jurisdiction, to treat it as a crime and assert the freedom of its

victims. He held this view in common with Gerrit Smith, and many other eminent men of the period, and brought to its support abilities of a high order both as a writer and speaker. In 1851, he published *The History of Slavery and Anti-Slavery*, a work of much careful research, which will be found valuable to future historians of the American anti-slavery movement. He was a deeply religious man, belonging theologically to the school of Hopkins and Emmons. He was licensed to preach, but not ordained.

GOODELL, WILLIAM, D.D (1792–1867); a Congregational minister and missionary, b. at Templeton, Mass., educated at Phillips academy, Andover, Dartmouth college, and Andover theological seminary. Having been accepted as a missionary by the American board, he traveled from New England to Alabama as an agent for raising funds, and visited the missions among the Choctaws and Cherokees east of the Mississippi. At the close of 1822 he sailed for Malta, and thence the next year to Beyroot, where he aided in establishing a station which has become eminently important as the center of the Syrian mission. The year following he commenced the study of Armeno-Turkish with the assistance of an ex-bishop of the Armenian church, Yakob Aga, and of a bishop, Dionysius Carabet, who afterwards joined the mission church. Thus unconsciously to himself he was preparing for his great work among the Armenian nation. In 1828, on account of threatened war between England and Turkey, the missionaries removed to Malta, where Mr. Goodell labored in preparing and printing books for the mission; until, in 1831, the way having been opened by the destruction of the Turkish fleet at Navarino, he went to Constantinople, where he commenced the Armeno-Turkish mission. During his missionary life he and his equally devoted wife cheerfully endured many trials and perils, and were compelled by fire, pestilence, political disturbance, war, persecution, extortion, and governmental interference to pack up their household goods and move their residence 33 times in 29 years. Unconquerable in effort, courteous in manner, of ready tact and resistless wit, he acquired great influence over the intelligent nation for whose good he worked; and won the respect and confidence of European ambassadors, ecclesiastical dignitaries, Armenian bankers, and other leading men. Those even who opposed his work were constrained to honor the worker. Few men equaled him in his wonderful power of doing good without giving offense, and of commending piety to the world. One of his chief labors was the translation of the Bible into Armeno-Turkish, in making and revising which he spent 20 years. In 1865, after 43 years of enthusiastic toil, he returned to the United States, and died in Philadelphia at the residence of his son.

GOODENIACEÆ, a natural order of exogenous plants, of which about 150 species are known, mostly herbaceous plants, although a few are shrubs, and mostly natives of Australia and the islands of the Southern ocean, a few being also found in India, the south of Africa, and South America. The order is allied to *campanulaceæ* and *lobeliaceæ*, but is destitute of the milky juice which is found in both of these. The corolla is monopetalous, more or less irregular. A remarkable character of this order is that the summit of the style bears a little cup, in the bottom of which the stigma is placed. The flowers of some of the species are of considerable beauty. The young leaves of *Scævola taccada* are used as a salad by the Malays; and the pith furnishes a kind of *rice-paper*, which they make into artificial flowers and other ornaments.

GOOD FRIDAY, the Friday before Easter, sacred as the commemoration of the crucifixion of our Lord. This day was kept as a day of mourning and of special prayer from a very early period. It was one of the two paschal days celebrated by the Christian church, and in memory of the crucifixion, was called by the Greeks *pascha staurosimon*, or the "Pasch of the Cross." That it was observed as a day of rigid fast and of solemn and melancholy ceremonial, we learn from the apostolic constitutions (b v. c. 18), and from Eusebius (*Eccl. Hist.* b. ii. c. 17), who also tells that, when Christianity was established in the empire, Constantine forbade the holding of law-courts, markets, and other public proceedings upon this day. In the Roman Catholic church, the service of this day is very peculiar; instead of the ordinary mass, it consists of what is called the mass of the presanctified, the sacred host not being consecrated on good Friday, but reserved from the preceding day. The priests and attendants are robed in black, in token of mourning; the altar is stripped of its ornaments; the kiss of peace is omitted, in detestation of the kiss of the traitor Judas; the priest recites a long series of prayers for all classes, orders, and ranks in the church, and even for heretics, schismatics, pagans, and Jews. But the most striking part of the ceremonial of Good Friday is the so-called "adoration of the cross," or, as it was called in the old English popular vocabulary, "creeping to the cross." A large crucifix is placed upon the altar with appropriate ceremonies, in memory of the awful event which the crucifix represents, and the entire congregation, commencing with the celebrant priest and his ministers, approach, and upon their knees reverently kiss the figure of our crucified Lord. In the eyes of Protestants, this ceremony appears to partake more strongly of the idolatrous character than any other in the Roman Catholic ritual; but Catholics earnestly repudiate all such construction of the ceremony. See IDOLATRY; IMAGES. The very striking office of "Tenebræ" is held upon Good Friday, as well as on the preceding two days. it consists of the matins and lauds of the office of holy Saturday, and has this peculiarity, that at

the close all the lights in the church are extinguished except one, which for a time (as a symbol of our Lord's death and burial) is hidden under the altar.

In the English church, Good Friday is also celebrated with special solemnity. Anciently, a sermon was preached at St. Paul's cross on the afternoon of this day, at which the lord mayor and aldermen attended. The practice of eating upon this day "cross buns"—cakes with a cross impressed upon them—is a relic of the Roman Catholic times, but it has lost all its religious significance. In England and Ireland, Good Friday is by law a *dies non*, and all business is suspended. In Scotland, the day meets with no peculiar attention, except from members of the Episcopal and Roman Catholic communions.

GOOD HOPE. See CAPE OF GOOD HOPE.

GOODHUE, a co. in s.e. Minnesota, intersected by the Milwaukee and St. Paul railroad and bounded on the n.e. by the Mississippi and lake Pepin; 750 sq.m.; pop. '70, 22,618. The surface is varied and the soil fertile. Chief productions, wheat, corn, barley, and butter. Co. seat, Red Wing.

GOODRICH, CHAUNCEY ALLEN, D.D., son of Elizur, 1790-1860; b. Conn.; graduated at Yale, where he was afterwards tutor, studied theology, and was ordained pastor of a Congregational church at Middletown, Conn., in 1816. In 1817 he became professor of rhetoric at Yale college, and in 1839 professor of pastoral theology. In 1820 he was elected president of Williams college, but declined. While tutor he published a Greek grammar which was widely used, and later Greek lessons, and Latin lessons. He superintended the abridgment of the dictionary of Dr. Noah Webster (his father-in-law). and the revision of that work in 1847 and 1859. For many years he edited the *Quarterly Christian Spectator*, and he published a volume entitled *Select British Eloquence*, containing critical sketches of distinguished orators of Great Britain in the last two centuries.

GOODRICH, ELIZUR, D.D., 1734-97; b. Conn.; graduated at Yale, where he was a tutor; was ordained a pastor of the Congregational church, Durham, Conn. He was a mathematician and astronomer.

GOODRICH, ELIZUR, LL.D., 1761-1849; b. Conn.; graduated at Yale, where he was a tutor. He was a lawyer, a member of congress, county and probate judge, mayor of New Haven, and professor of law in Yale college.

GOODRICH, FRANK BOOT, b. Boston, 1826; son of Samuel Griswold Goodrich; graduated at Harvard, and was for some time the Paris correspondent of the *New York Times*, under the signature of "Dick Tinto." In 1854 he published *Tri-colored Sketches of Paris*, in later years *The Court of Napoleon*, *Man upon the Sea*, and *Women of Beauty and Heroism*.

GOODRICH, SAMUEL GRISWOLD, 1793-1861; b. Conn. He was a book publisher in Hartford and Boston. In the latter city he was the editor of the *Token*, an illustrated annual. He is best known as Peter Parley, a nom de plume which he assumed in writing a series of books for children, which extended through more than a hundred volumes. He was U. S. consul at Paris, where he published in 1852 a statistical work on the United States. Among his works are *The Outcast and Other Poems; Fireside Education; Sketches from a Student's Window; Recollections of a Life-Time;* and *Illustrated Natural History of the Animal Kingdom.*

GOODS AND CHATTELS, a legal as well as popular phrase in common use, to signify personal property. It is not unfrequently used in wills, but seldom in any other legal instrument; and when used in wills, it generally includes all the personal property of the testator. In Scotland, the corresponding phrase is goods and gear.

GOODS IN COMMUNION, the name given in the law of Scotland, France, and some other countries, to the personal property of a married couple, which is not subject to any deed, but left to the operation of the common law. In England, such a phrase is unknown, for upon marriage, all the personal property which previously belonged to the woman (which is not secured by any deed or will), as well as what was previously his own, becomes and continues the husband's absolutely—he is entire master of it, and can do what he likes with it, regardless of the wishes of his wife or children, and he may even bequeath it away to strangers. In Scotland, the theory is not so liberal towards the husband, though in practice there is not much difference. By the law of Scotland, the husband can also do what he likes with the personal property of both parties, if there is no previous marriage-contract or other deed governing the subject-matter. He can almost squander it at will. It is only at his death that the theory of a kind of partnership, or of a communion of goods, comes into play.

Until 1855, when the law was altered, this theory prevailed when the wife died, for formerly, at her death, the goods were divided into two parts, if there were no children, and one-half went to the next of kin of the wife, however distant the relationship, and not to the husband. But now, by statute 18 Vict. c. 23, s. 6, when a wife dies before the husband, her next of kin takes no interest whatever in the goods in communion; and the law in this respect is now the same as it is in England. Hence the phrase goods in communion is less appropriate than it was before 1855. If, however, the husband

die, the goods in communion suffer a division on the principle of a partnership. Thus, if there are no children, half goes to the widow, and the other half to the next kin of the husband. If there are children, then one-third goes to the widow, and is often called her *jus relictæ* (q.v.), and the other two-thirds to the children equally, if there is no will; or if there is a will, then one-third to them, called the *legitim* (q.v.). The same division also takes place in England, when there is no will; but this is done in England by virtue of a statute 29 Charles II. c. 8, called the statute of distributions (q.v.), whereas this effect is produced in Scotland not by a statute, but by the common law. Practically, this distinction, though important to be known by lawyers, may seem immaterial to laymen.

Another more important distinction, however, both theoretically and practically, is this: The above division of the goods in communion prevails in Scotland whether the husband has left a will or not; in short, it prevails in spite of his will, and all that a husband having a wife and children can do by means of a will, is to bequeath one-third of his personal estate to strangers, and this third is usually called on that account the *dead's part* (q.v.). Thus, in Scotland, on the death of the husband, the wife and children have an indefeasible interest in two-thirds of his personal property, and this inchoate interest during life gave rise to the phrase "goods in communion." In England, on the contrary, the will, if there is one, may carry away all the personal property to strangers, regardless of the wife and children. Hence, the result may be stated shortly thus: in Scotland, a man cannot disinherit his wife and children; whereas in England he can. See other incidents of this distinction in Paterson's *Compendium of English and Scotch Laws*, ss. 673, 738. If there is a marriage-contract or antenuptial settlement between the husband and wife, the rights both of the wife and children may be materially varied, for the rule then is, that the parties may make what arrangement they please by way of contract, and in such settlements a fixed sum is generally provided both to the wife and children, in lieu of what they would be entitled to at common law, i.e., where no express contract is made.

GOODSIR, JOHN, professor of anatomy in the university of Edinburgh from 1846 to 1867, was b. in 1814, at Anstruther, Fifeshire, in which county his father and grandfather had, for many years, practiced the profession of medicine with great repute. Very early in life his studious habits and thoughtful disposition attracted attention, and when little more than a boy, he was sent to the university of St. Andrews, where he passed through a four years' course of literary and philosophic study. He was afterwards apprenticed to Mr. Nasmyth, dentist in Edinburgh, and during his apprenticeship, attended the medical classes both in the university and extra-mural school in that city. He studied anatomy under Dr. Knox, and natural history under prof. Jameson, and was the intimate friend of Edward Forbes, George Wilson, Samuel Brown, and other young men, who have since made for themselves names as ardent students of the natural sciences.

The position of his native town on the sea-coast had very early caused his attention to be directed to marine zoology, and along with his younger brother, Harry, who was afterwards lost in the unfortunate Franklin expedition, he had begun to dissect marine animals, and study their forms and structure, before he commenced his medical studies. His training as a dentist led him to undertake an investigation into the development and structure of the teeth, which he afterwards published in an elaborate memoir, and in which he gave the first consistent account of the various stages through which these important organs pass. This essay, published in 1839, at once caused him to be recognized as an observer of great originality and acuteness. On obtaining his diploma at the college of surgeons, in Edinburgh, he returned to Anstruther, to assist his father in practice; and though actively engaged for some years in the arduous duties of a country doctor, he yet found time, not only to pursue numerous important pathological investigations, but to continue and extend his studies in anatomy and natural history. He formed at the same time an anatomical museum, characterized by the great beauty of the preparations, which was afterwards acquired by the government for the use of the Queen's college, Cork.

He returned to Edinburgh about 1840; and on the conservatorship of the museum of the royal college of surgeons becoming vacant, he applied for, and obtained, the office. Having now acquired a more extensive field for pathological research, he devoted much attention to the structure and mode of growth of tumors, and other products of disease; and in 1842–43, he delivered courses of lectures on the diseases of bone, cartilage, and of the various changes which take place in inflammation of these and other important organs. The improvements in the construction of the compound microscope, about this period, furnished him with a most valuable instrument for conducting his inquiries into the more recondite structural phenomena, which constitute the fundamental nature of the changes from a healthy to a diseased condition of tissues and organs. At the same time, he also investigated the minute structure of the healthy tissues, more especially with reference to the mode in which they performed their functions. He was one of the first observers who strongly insisted on the general diffusion, throughout the animal textures, of the minute bodies called *nuclei;* and he pointed out their importance in connection with the processes of growth, secretion, and nutrition. His memoir on

secreting structures, published in 1842, in the *Transactions of the Royal Society of Edinburgh*, showed, in a most conclusive manner, the influence exercised by the cells within a gland on the sécretion formed in its interior. In the same year, he published a description of a case, in which a very remarkable vegetable organism, now known as the *sarcina ventriculi* (see SARCINA), was periodically discharged in the fluid ejected from the stomach during vomiting In the following year, he communicated to the royal society of Edinburgh an account of the structure of the human placenta, which is regarded as a most important contribution to the anatomy of that complex organ. Many of his physiological and pathological essays were afterwards incorporated in a special volume, published in 1845, and the facts which they contain have contributed very materially to establish the important modern pathological doctrine of the origin of morbid products from changes in the pre-existing elements of the tissues of the body.

His studies in comparative anatomy and natural history were not, however, neglected during this period. He was an active member of the Wernerian society, and, along with his friend, Edward Forbes, communicated both to it and other scientific bodies several papers on the anatomy of animals, new to science, which they had discovered. His papers on Pelonaia, Thalassema, and Amphioxus attracted especial attention.

In 1844, he was appointed assistant to Dr. Monro, professor of anatomy in the university of Edinburgh. His enthusiasm and devotion to anatomical work rapidly gathered around him a large class of students, and on the resignation of Dr. Monro in 1846, he was appointed by the town-council to the chair of anatomy. His reputation as an anatomical teacher now became materially extended, numerous students were attracted to his class, and for many years the attendance each winter-session amounted to between 300 and 400. His great success as a teacher was due, not so much, perhaps, to any special aptitude for public speaking, but to the earnest and painstaking way in which he brought his subject before his students; to his thorough knowledge of anatomy, not only in its minute details, but in its relations to physiological and pathological processes; and to the influence exercised by his manly and straightforward character. He devoted much of the time not occupied in the duties of his class to the extension of the anatomical muśeum of the university, and dissected and prepared a large number of specimens to illustrate the modifications, in form and structure, of the organs met with in the dissection of different kinds of animals. His preparations of the echinodermata, mollusca, and cetacea, are especially worthy of notice.

He had a keen sense of the beauty and symmetry of organic forms, and his philosophic mind early led him to undertake an investigation into the constitution of the skeleton in the vertebrata, the general results of which he communicated, in the year 1856, to the British association for the advancement of science.

His devotion to work, and his unremitting attention to the duties of his chair, at length began to tell on his robust frame; and for some years before his death, signs of failing health were visible. Early in 1867 he was obliged to withdraw from all active work; and he died at South Cottage, Wardie (near Edinburgh), Mar. 6, in that year.

Goodsir's intellect was eminently comprehensive. He was not a mere technical anatomist, but studied his science in its relations to morphology, teleology, and pathology. In his philosophic grasp of principles, in the extent of his acquirements, and in his devotion to his science, he was a worthy disciple of his great compatriot, John Hunter. For a full account of his life, etc., see *Anatomical Memoirs of John Goodsir*, published under the editorship of his successor in the chair of anatomy, prof. Turner (Longman's, 1868).

GOOD TEMPLARS, INDEPENDENT ORDER OF, a secret society established in central New York in 1851, mainly through the energy and skill of Nathaniel Curtis, reformed by the Washingtonians. Its basis is total abstinence from intoxicating liquor as a beverage, and the prohibition of its manufacture, importation, and sale for that purpose. It has a liberal financial basis, secured by quarterly pass-words obtainable only on payment of dues. It aims to diffuse its principles through the press, lectures, and meetings. The subordinate lodges, averaging each 100 members, hold weekly meetings; the county or district lodges are composed of delegates from the subordinate lodges, and meet monthly or quarterly; the supreme representative body, or the international grand lodge, or most worthy grand lodge of all the world, meets triennially. Each state, kingdom, or other political division has its right worthy grand lodge, which meets annually, and elects representatives to the supreme body. There are degrees and methods of recognition. The first lodge in England was formed in Birmingham, May, 1868; the second in Glasgow, Scotland, 1869. In 1874 there were in the United Kingdom 3,743 lodges, and 210,255 members. In the United States and a few foreign places, exclusive of England, there were, Jan. 31, 1880, 5,965 lodges, and 254,993 members. There are now 64 grand lodges in the United States, England, Canada, Australia, New Zealand, Madagascar, and India, and the total number of members is estimated at 617,-738. Nearly 200,000 children in the order of good templars are pledged to total abstinence. Since the origin of the society, 2,900,804 persons have become members, of whom 290,000 had been inebriates, and of these 145,000 have kept the pledge and been active laborers in the reform.

GOOD-WILL is rather a short popular expression than a legal term. It means that kind of interest which is sold along with any profession, trade, or business. In reality, it is not the business that is sold, for that is not a distinct thing recognized by the law, but the house, shop, fixtures, etc., are sold, and the trade debts; and along with transferring these, the seller binds himself, either by covenant or agreement, to do everything in his power to recommend his successor, and promote his interests in such business. If the seller acts contrary to such agreement, he is liable to an action. But the more usual course is for the seller to enter into an express covenant not to carry on the same business within 30, 40, or 100 m., or some specified moderate distance from the place where the purchaser resides. At first, such a covenant was sought to be set aside as invalid, on the ground that it tended to restrain the natural liberty of trade; but the courts have now firmly established that if a definite radius of moderate length is fixed upon, it does not sensibly restrain trade, inasmuch as the person covenanting can go beyond those limits, and trade as much as he pleases. Hence, such limitations are a fair matter of bargain, and upheld as valid. If the party break his covenant, he is liable to an action for damages.

GOODWIN, Daniel Raynes, D.D., LL.D., b. 1811; graduated at Bowdoin college; became a pastor in the Protestant Episcopal church; was professor of modern languages in Bowdoin; president of Trinity college, Hartford; provost of the university of Pennsylvania, and professor of systematic divinity in the divinity school of the Protestant Episcopal church in Philadelphia.

GOODWIN, Thomas, 1600–1679; an English divine of the later Puritan period. In 1625 he was licensed a preacher of the university; and three years later became lecturer of Trinity church, the vicarage of which he was presented by the king in 1632. Harassed by the constant interference of his bishop, who was a zealous adherent of Laud, he resigned his preferments and left the university in 1634. He then seems to have lived for some time in London, where, in 1638, he married the daughter of an alderman; but, in the following year, he found it expedient to withdraw to Holland, and for some time was pastor of a small congregation of English merchants and refugees at Arnheim. Returning to London soon after Laud's impeachment by the long parliament, he ministered for some years to an independent congregation in the parish of St. Dunstan's-in-the-East, and rapidly rose to considerable eminence as a preacher; in 1643 he was elected a member of the Westminster assembly, and at once identified himself with the Congregational party. He frequently preached by appointment before the commons, and, in Jan., 1650, his talents and learning were rewarded by the house with the presidentship of Magdalen college, Oxford, a post which he held until the restoration. He rose into high favor with the protector, and ultimately became somewhat prominent among his more intimate advisers. From 1660 until his death he lived in London, and devoted himself exclusively to theological study and to the pastoral charge of a small congregation which his piety and intellectual abilities had attached to him.

GOODWIN SANDS, famous banks of shifting sands stretching about 10 m. in a direction n.e. and s.w., off the e. coast of Kent, at an average distance of 5½ m. from the shore. The sands are divided into two portions by a narrow channel, and at low water, many parts are uncovered. When the tide recedes, the sand becomes firm and safe; but after the ebb, the water permeates through the mass, rendering the whole pulpy and treacherous, in which condition it shifts to such a degree as to render charts uncertain from year to year. The northern portion is of triangular form—3½ m. long, and 2½ in its greatest width; on the northernmost extremity, known as North Sand Head, a light vessel marks the entrance on this perilous shoal. This light is distant about 7 m. from Ramsgate. In the center, on the western side, jutting out towards the shore, is the Blunt Head, a peculiarly dangerous portion, also marked by a light-ship. The southern portion is 10 m. in length, 2½ in width at its northern end, and sloping towards the s.w., to a point called South Sand Head, which, being marked by a light-vessel, completes the triangle of dangerous proximity recorded for the benefit of mariners.

From the sunken nature of these sands, they have always been replete with danger to vessels passing through the strait of Dover, and resorting either to the Thames or to the North sea. On the other hand, they serve as a breakwater to form a secure anchorage in the downs (q.v.), when easterly or south-easterly winds are blowing. The downs, though safe under these circumstances, become dangerous when the wind blows strongly off-shore, at which time ships are apt to drag their anchors, and to strand upon the perfidious breakers of the Goodwin, in the shifting sands of which their wrecks are soon entirely swallowed up. Many celebrated and terribly fatal wrecks have taken place here, among which we have only space to enumerate the three line-of-battle-ships, *Stirling Castle*, *Mary*, and *Northumberland*, each of 70 guns, which, with other ten men-of-war, were totally lost during the fearful gale of Nov. 26, 1703, a gale so tremendous that vessels were actually destroyed by it while riding in the Medway. On Dec. 21, 1805, here foundered the *Aurora*, a transport, when 300 perished; on Dec. 17, 1814, the *British Queen*, an Ostend packet, was lost with all hands; and on Jan. 5, 1857, during a gale of eight days' duration, in which several other vessels were lost, the mail steamer *Violet* was

destroyed, involving the sacrifice of many lives in the catastrophe. From these dates, it will be seen that the greatest dangers are to be apprehended in the winter months.

These dangerous sands are said to have consisted at one time of about 4,000 acres of low land, fenced from the sea by a wall. One well-known tradition ascribes their present state to the building of the Tenterden steeple, for the erection of which the funds that should have maintained the sea-wall had been diverted: this traditionary account is of little, if any, value. Lambard, in writing of them, says: "Whatsoever old wives tell of Goodwyne, Earle of Kent, in time of Edward the Confessour, and his sandes, it appeareth by Hector Boëtius, the Brittish chronicler, that theise sandes weare mayne land, and some tyme of the possession of Earl Godwyne, and by a great inundation of the sea, they weare taken therfroe, at which tyme also much harme was done in Scotland and Flanders, by the same rage of the water." At the period of the conquest by William of Normandy these estates were taken from earl Godwin, and bestowed upon the abbey of St. Augustine at Canterbury, the abbot of which allowing the sea-wall to fall into a dilapidated condition, the waves rushed in, in the year 1100, and overwhelmed the whole. How far this account of the formation of this remarkable shoal can be relied on, is a matter of considerable doubt, the documentary evidence on the subject being scanty and unsatisfactory. A colorable confirmation is, however, to be deduced from the fact of the successive inroads which the sea has made for centuries past, and is still making along the whole e. coast of England.

As a precaution, now, in foggy weather, bells in the light-ships are frequently sounded. Difficulty is experienced in finding firm anchorage for these vessels; and all efforts to establish a fixed beacon have been hitherto unsuccessful. In 1466 a light-house on piles of iron screwed into the sand was erected, but it was washed away in the following year. As soon as a vessel is known to have been driven upon the sands, rockets are thrown up from the light-vessels, and the fact thus communicated to the shore. The rockets are no sooner recognized, than a number of boatmen, known all along the coast as "hovelers," immediately launch their boats and make for the sands, whatever may be the state of wind and weather. These "hovelers" regard the wreck itself as their own property, and although during fine weather they lead a somewhat regardless as well as a wholly idle and inactive life, their intrepidity in seasons of tempest is worthy of all praise.

GOODYEAR, Charles, American inventor, was born at New Haven, Conn., Dec. 29, 1800, the son of an iron-manufacturer, with whom, at the age of 21, he went into business in Philadelphia. Failing in the iron trade, his attention was attracted to the manufacture of india-rubber, and he expended all his means, and reduced his family to utter destitution, in experiments with various mixtures and processes, the most successful of which were with magnesia, lime, and nitric acid, to make it available for waterproof shoes, clothing, etc. His efforts were a series of failures, excepting a partial success in treating the surface of rubber goods with nitric acid, until he bought of one Hayward, a rival experimenter, an invention for mixing india-rubber with sulphur. The great secret of vulcanization, in which the two substances, submitted to a high temperature, are converted into the elastic, enduring, and heat and cold-defying fabrics now in use, was an accidental discovery made while standing by a stove, and idly subjecting a mixture of rubber and sulphur to its heat. This new product he patiently perfected, discovering new uses to which it could be applied, until it required sixty patents to secure his inventions. Some of these rights were secured by other persons in England, and in France they were forfeited by an informality; so that, by these means, and from expensive law-suits, he gathered little from 10 years of toil and privations save the honors awarded to his skill and perseverance in giving to the world a staple now applied in different countries to 500 uses, and employing 60,000 workmen in its manufacture. He died in 1860.

GOOKIN, Daniel, 1612–87; b. England; at the age of 9 accompanied his father, a colonist, to Virginia, but the Indians proved so troublesome that, in 1644, the family removed to Massachusetts, the more readily for the reason that their sympathies were with the Puritans. In 1665 he was made superintendent of Indian affairs in Cambridge, Mass., a position which he maintained during life. Gookin was one of the colonists who shielded Goffe and Whalley, the fugitive regicides. In military rank he rose to maj.gen., but died in such poverty that a subscription was raised for his widow. He wrote *Historical Collections of the Indians in Massachusetts down to* 1674.

GOOLAI'REE, or Gomul' Pass, an important pass in the n.w. of India, across the Suliman range from the Derajat into Cabul. It enters the mountains at their eastern base, in lat. 32° 6' n., and long. 70° east. It holds its course, which is very winding, by broken rugged roads, or rather the water courses of the Gomul, through the wild and mountainous country of the Muzarees. It and the Kurran pass are the best known of the middle routes from Hindustan to Afghanistan, as the Khyber is the northern, and the Bolan the southern. Immense caravans, consisting principally of Lohani Afghans, every spring traverse it westward from the Indus and the adjacent countries, and returning in the autumn, winter in the Derajat. It is much infested by freebooters of the Vaziri Afghan tribe, and the caravans have often to fight their way with much loss of life and property.

GOOLE, a thriving market-town and river-port of England, in the west riding of Yorkshire, is situated on the right bank of the Ouse at its junction with the Dutch river, 22 m. s.s e. of York. It has only recently risen into importance, and may be said to date the commencement of its prosperity from its establishment as a bonding-port in 1829. It has commodious ship, barge, and steam-vessel docks, a patent slip for repairing vessels, ponds for bonded timber, a neatly-built custom-house, and extensive warehouse accommodation. Goole has a considerable trade in ship and boat-building, sail-making, iron-founding, and agricultural machine-making; it has also several corn-mills, some of which are worked by steam. Coal is largely exported along the coast, and in considerable quantities to London. In 1875, 3,836 vessels, of 550,052 tons, entered and cleared the port. Pop. '71, 7,680.

GOORKHAS. See GORKHA, *ante.*

GOOSANDER, *Mergus Merganser*, a web-footed bird of the same genus with those commonly called mergansers (q.v.), and the largest of the British species. It is larger than a wild duck; the adult male has the head and upper part of the neck of a rich shining green; the feathers of the crown and back of the head elongated, the back black and gray, the wings black and white, the breast and belly of a delicate reddish buff color. The female has the head reddish brown, with a less decided tuft than the male, and much grayer plumage, and has been often described as a different species, receiving the English name of *dundiver*. Both mandibles are furnished with many sharp serratures or teeth directed backwards, the nearest approach to true teeth to be found in the mouth of any bird. See also BILL. The goosander is a native of the arctic regions, extending into the temperate parts of Europe, Asia, and America; in the southern parts of Britain, it is seen only in winter, and then only in severe weather, the females and young migrating southwards in such circumstances more frequently than the old males, and not unfrequently appearing in small flocks in the s. of Scotland and n. of England; but in some of the northern parts of Scotland and the Scottish isles it spends the whole year. It feeds on fish, crustaceans, and other aquatic animals which its serrated bill and its power of diving admirably adapt it for seizing. The flesh of the goosander is extremely rank and coarse, but the eggs appear to be sought after by the inhabitants of some northern countries.

GOOSE, *Anser*, a genus of web-footed birds, one of the sections of the Linnæan genus *anas* (q.v.), having the bill not longer than the head, more high than broad at the base, the upper mandible slightly hooked at the tip; the legs placed further forward than in ducks, and so better adapted for walking; the neck of moderate length, with 16 vertebræ, a character which widely distinguishes them from swans. In general, geese spend more of their time on land than any other of the *anatidæ*, feeding on grass and other herbage, berries, seeds, and other vegetable food. Although large birds, and of bulky form, they have great powers of flight. They strike with their wings in fighting, and there is a hard callous knob or tubercle at the end of the wing, which in some species becomes a spur. The DOMESTIC GOOSE is regarded as deriving its origin from the GRAY LAG GOOSE or COMMON WILD GOOSE (*A. ferus*); but all the species seem very capable of domestication, and several of them have been to some extent domesticated. The gray lag goose is almost 3 ft. in length from the tip of the bill to the extremity of the short tail. Its extent of wing is about 5 feet. The wings do not reach to the extremity of the tail. The weight of the largest birds is about 10 pounds. The color of the plumage is gray, varying in some parts to grayish brown; the rump and belly white, the tail grayish brown and white; the bill is orange, the *nail* at the tip of the upper mandible white. The young are darker than the adults. The gray lag goose is common in some parts of the center and s. of Europe, also in many parts of Asia, and in the n. of Africa, but it is not known in America. It is a bird of temperate rather than of cold climates. In some countries, it is found at all seasons of the year, but it deserts its most northern haunts in severe weather, migrating southward; its flocks, like those of others of this genus, flying at a great height, beyond the reach of shot, except of the rifle, one bird always leading the flock, the rest sometimes following in a single line, but more generally in two lines converging to the leading bird. The gray lag goose was formerly abundant in the fenny parts of England, and resided there all the year, but the drainage of the fens has made it now a rare bird, and only known as a winter visitant in the British islands. It frequents bays of the sea and estuaries as well as inland waters, and often leaves the waters to visit moors, meadows, and cultivated fields, generally preferring an open country, or taking its place, as remote as possible from danger, in the middle of a field. These excursions are often made by night, and no small mischief is often done by a flock of hungry geese to a field of newly-sprung wheat or other crop. At the breeding-season, the winter-flocks of wild geese break up into pairs; the nests are made in moors or on tussocks in marshes; the eggs vary in number from 5 to 8 or rarely 12 or 14; they are of a dull white color, fully 3 in. long, and 2 in. in diameter.

Although the common goose has been long domesticated, and it was probably among the very first of domesticated birds, the varieties do not differ widely from each other. *Emden geese* are remarkable for their perfect whiteness; *Toulouse geese*, for their large size. As a domesticated bird, the goose is of great value, both for the table, and on

account of its quills, and of the fine soft feathers. The quills supplied all Europe with pens before steel pens were invented, and have not ceased to be in great demand. Geese must have free access to water, and when this is the case, they are easily reared, and rendered profitable. Two broods are sometimes produced in a season, 10 or 11 in a brood, and the young geese are ready for the table in three months after they leave the shell. They live, if permitted, to a great age. Willoughby records an instance of one that reached the age of 80 years, and was killed at last for its mischievousness. Great flocks of geese are kept in some places in England, particularly in Lincolnshire, and regularly plucked five times a year for feathers and quills. Geese intended for the table are commonly shut up for a few weeks, and fattened before being killed. Great numbers are imported from Holland and Germany for the London market, and fattened in England in establishments entirely devoted to this purpose. *Goose-hams* are an esteemed delicacy. The gizzards, heads, and legs of geese are also sold in sets, under the name of *giblets*, to be used for pies. The livers of geese have long been in request among epicures; but the *pâté de foie d'oie*, or *pâté de foie gras* of Strasburg, is made from livers in a state of morbid enlargement, caused by keeping the geese in an apartment of very high temperature. Large goose-livers were a favorite delicacy of the ancient Roman epicures.

The gray lag goose is the largest of the native British species. The next to it in size, and by far the most abundant British wild goose, is the BEAN GOOSE (*A. segetum*), a very similar bird; the bill longer, orange, with the base and nail black; the plumage mostly gray, but browner than in the gray lag goose, the rump dark brown. The wings extend beyond the tail. The habits scarcely differ from those of the gray lag goose, but the bean goose is a more northern species. It is common in all the northern parts of Europe and Asia; and great numbers breed in Nova Zembla, Greenland, and other most northern regions. Large flocks are to be seen in many parts of Britain in winter, particularly during severe frosts, but a few also breed in the n. of Scotland, and even in the n. of England. The bean goose is easily domesticated, but generally keeps apart from the ordinarily tame geese.—The WHITE-FRONTED GOOSE, or LAUGHING GOOSE (*A. albifrons*), is a frequent winter visitant of Britain; a native of Europe, Asia, and America, breeding chiefly on the coasts and islands of the arctic seas. It is only about 27 in. in its utmost length. The plumage is mostly gray; there is a conspicuous white space on the forehead. It has been often tamed.—Similar to it in size is the PINK-FOOTED GOOSE (*A. brachyrhynchus*), a species which has a very short bill. In England it is rare, and a mere winter visitor, but it breeds in great numbers in some of the Hebrides.—The SNOW GOOSE (*A. hyperboreus*) is found in all the regions within the Arctic circle, but most abundantly in America, where it migrates southward in winter, as far as the gulf of Mexico. It is somewhat smaller than the bean goose. The general color of the plumage is pure white, the quill feathers brownish black. The feathers imported from the Hudson's bay territories are in great part the produce of this beautiful species, and probably many of the fine white goose feathers imported from Russia. Its flesh is greatly esteemed.—The CANADA GOOSE (*A. Canadensis*) is one of the most abundant North American species, breeding even in the milder latitudes, but in vast numbers in the more northern parts, from which it migrates southwards on the approach of winter. It was introduced into Britain at least 200 years ago, and may now be regarded as fully naturalized; a great ornament of lakes and artificial ponds, from which it makes excursions in small flocks over the surrounding districts. In the uniform breadth of the bill it resembles swans. It is fully 3½ ft. from the tip of the bill to the extremity of the tail; but its neck is long and slender, and it does not exceed the common goose in weight, so much as in length. The bill, the feet, the head, great part of the neck, the quill-feathers, the rump, and the tail are black; there is a crescent-shaped white patch on the throat, whence this species has received the name of the CRAVAT GOOSE; the back, wings, and flanks are grayish brown, the breast and belly pure white. The Canada goose has a peculiar resounding hoarse cry. It is easily reduced to the most complete domestication. Its flesh affords great part of the winter supplies of the Hudson's bay residents, and is much used in a salted state.—The CHINA GOOSE, or GUINEA GOOSE (*A. Guineensis* or *cygnoides*), of which the native country is supposed to be Guinea, has long been known in Britain in a state of domestication. It has an elevated knob at the base of the upper mandible, which has obtained it the name of knobbed goose.—Other species of geese are noticed in the articles BARNACLE GOOSE and CEREOPSIS; and species closely allied to those noticed in this article are found in India and other parts of the world.

GOOSEBERRY (*grossularia*), a sub-genus of the genus *ribes* (see CURRANT), distinguished by a thorny stem, a more or less bell-shaped calyx and flowers on 1 to 3-flowered stalks.—The common gooseberry (*ribes grossularia*) is a native of many parts of Europe and the n. of Asia, growing wild in rocky situations and in thickets, particularly in mountainous districts; but it is a doubtful native of Britain, although now to be seen in hedges and thickets almost everywhere. Some botanists have distinguished as species the variety having the berries covered with gland-bearing hairs (*setæ*); that having the germens covered with soft unglandular hairs, and the berries ultimately smooth; and that which has even the germens smooth (*R. grossularia*, *R. uva-crispa*, and *R. reclinatum*);

but these varieties seem to have no definite limits in nature. The varieties produced by cultivation are very numerous, chiefly in England, where, and particularly in Lancashire, greater attention is paid to the cultivation of this valuable fruit-shrub than in any other part of the world. In the s. of Europe it is little known. It does not appear to have been known to the ancients. Its cultivation cannot be certainly referred to an earlier date than the 17th c., and was only in its infancy at the middle of the 18th, when the largest gooseberries produced in Lancashire scarcely weighed more than 10 dwts., whereas the prize-gooseberries of that county now sometimes exceed 30 dwts. Many well-known diversities of form, color, and flavor, as well as of size, mark the different varieties. For the production of new varieties, the gooseberry is propagated by seed; otherwise, generally by cuttings, which grow very freely. Any good garden soil suits the gooseberry. It is rather the better for a little shade, but suffers from much. The bushes are trained in various ways, but it is necessary to prune so that they may not be choked up with shoots, whilst care ought to be taken to have an abundant supply of young wood, which produces the largest berries. Besides its well-known wholesomeness and pleasantness, and its use for making an excellent preserve and jelly, the ripe fruit is used for making wine and vinegar. An effervescent gooseberry wine, which might well claim attention under its own name, is often fraudulently sold as champagne. The use of unripe gooseberries for tarts increases the value of this fruit-shrub. The gooseberry season is prolonged by training plants on n. walls, and by covering the bushes with matting when the fruit is about ripe. Unripe gooseberries are kept in jars or bottles, closely sealed, and placed in a cool cellar, to be used for tarts in winter. When the bottles are filled, they are heated, by means of boiling water or otherwise, to expel as much air as possible before they are corked and sealed. Various derivations have been given of the name gooseberry, but most probably the first syllable is a corruption of *groseille*, the French name of the fruit, from which also comes the Scotch *grozet* or *grozart*. In some parts of England, the gooseberry is called *feaberry*.—Among the other species of gooseberry most worthy of notice are *R. cynosbati*, a native of Canada, of Japan, and of the mountains of India, much resembling the common gooseberry in foliage and habit, the fruit more acid than the cultivated gooseberry; *R. divaricatum*, a native of the n.w. coast of America, with smooth, black, globose, acid fruit; *R. irriguum*, also from the n.w. coast of America, with well-flavored globose fruit, half an inch in diameter; *R. oxyacanthoides*, a native of Canada, with small, globose, red, green, or purplish berries of an agreeable taste; *R. gracile*, found in mountain-meadows from New York to Virginia, with blue or purplish berries of exquisite flavor; *R. aciculare*, a Siberian species, with sweet, well-flavored yellowish or purplish smooth berries; all of which, and probably others, seem to deserve more attention than they have yet received from horticulturists.—The SNOWY-FLOWERED GOOSEBERRY (*R. niveum*), a native of the n.w. coast of America, is remarkable for its beautiful white pendulous flowers. Its berries in size and color resemble black currants, are acid, with a very agreeable flavor, and make delicious tarts. Another species from the same region (*R. speciosum*) is very ornamental in pleasure-grounds, and is remarkable for its shining leaves, its flowers with four stamens—the other species having five—and the great length of the filaments.—*R. saxatile*, a native of Siberia, and other species, forming a sub-genus called *botrycarpum*, have a character somewhat intermediate between currants and gooseberries, being prickly shrubs, but having their flowers in racemes. *R. saxatile* has small, smooth, globose dark purple berries, like currants, which are very agreeable.

GOOSEBERRY, COROMANDEL. See CARAMBOLA.

GOOSEBERRY, PERUVIAN. See PHYSALIS.

GOOSEBERRY CATERPILLAR, the larva of *abraxas grossulariata*, a moth of a whitish color, with yellow streaks, and spotted with black. The larva is beautifully colored, with black and white stripes, and in its progression forms an elevated loop with its body. It feeds on the foliage of the gooseberry and currant.—Another moth, of which the caterpillar also feeds on the leaves of these shrubs, is *halias vanaria*. Both the moth and the caterpillar are smaller than the former. But more destructive than either of these is the larva of a saw-fly, *nematus ribesii*, which deposits its eggs along the ribs on the under surface of the leaves; the larva is green and "shagreened" with minute black tubercles. Many remedies have been proposed and tried to prevent the ravages of these larvæ, of which, perhaps, the best are picking off the leaves observed to be covered with the eggs of the saw-fly, and dusting with powder of white hellebore, which, if carefully and sufficiently applied, is most efficacious, killing any kind of larva.

GOOSE FISH (angler), one of the ugliest and most voracious of the *lophiadæ*. It is about 3 ft. long and has a broad, flat, and enormous head, with a wide mouth supplied with sharp conical teeth. There are spines on the head and a fleshy fringe around the lower jaw. Five species are known. The *L. Americanus* and *L. piscatorius* are most common.—The American angler grows to 4 or 5 ft. in length, and weighs sometimes 60 or 70 lbs. This voracious glutton devours all sorts of fish that it can capture, as well as ducks and gulls. It is known as the sea-devil, fishing frog, and angler.

GOOSE LAKE, a body of water in w. Oregon and California about 30 by 10 miles. The greater portion is in Modoc co., Cal., and the outlet is Pitt river, one of the principal streams of the Sacramento.

GOPHER, a name of somewhat indefinite significance, varying in different localities, where it is used to designate different animals. It is a corruption of the French word *gauffre*, a honeycomb, which was applied by the French settlers in America to various burrowing animals which "honeycomb" the soil. The term gopher or gauffre is applied not only to burrowing mammalians, but, in the southern states, to the large land tortoise (*testudo polyphemus*, see TORTOISE), and in Georgia, it is said, to a species of snake. The mammalian gophers, to which the name is more popularly applied, belong to the order RODENTIA, family *muridæ*, which embraces the rats, mice, hamsters, lemmings, voles, etc. The gophers are not confined to one genus, and other families embrace animals having all the gopher characteristics. Under the genus *geomys*, Rafinesque placed the hamsters of Georgia (*G. pinetis*) and the pouched rat of Canada (*G. bursarius*). In the genus *diplostoma*, he placed some Missouri and Louisiana animals, says sir John Richardson, "known to the Canadian voyagers by the appellation of gauffres," and remarkable for their large cheek pouches. These two genera have been adopted by few naturalists; and the American systematic writers have either overlooked M. Rafinesque's species entirely, or referred them all to *G. bursarius*, and he says, "in the latter case they are undoubtedly wrong, for there are at least six or seven distinct species belonging to one or other of these genera which inhabit America," and he thinks that "both *geomys* and *diplostoma* will eventually prove to be good genera; the small sand-rats belonging to the former having cheek pouches which are filled from within the mouth, and the gauffres or camas-rats of the latter genus having their cheek pouches exterior to the mouth, and entirely unconnected with its cavity." The animal usually called the pouched gopher (*G. bursarius*) is found in Canada, Missouri, Illinois, Iowa, Texas, Mexico, and the gulf states, but, it is said, not n. of the Savannah river. It is about 9 in. long, with an almost hairless tail about 2 in. long, and weighs about 13 ounces. Its legs are short; fore feet strong, and well adapted for burrowing, having five claws, the three middle ones very large and long. The claws on the hind feet are small, but the two middle ones longer than the others, the interior one being almost rudimentary. It has twenty teeth; eight upper and eight lower molars, and four incisors which are very strong, especially the lower pair, which are much longer than the upper. The ears are very small. The animal is reddish-brown on the back and sides, ashy beneath, and has white feet. It burrows in sandy soils, throwing up the earth in little mounds. It subsists on grass, roots, nuts, buds, and farm vegetables. Its most remarkable characteristic is the possession of pouches which cover the side of the head, and are capable of being so distended as to enable the animal to carry a considerable load of provisions. The true southern gopher, or Georgia hamster (*G. pinetis*), is a larger animal, found in Alabama, Georgia, and Florida. Prof. Baird describes five other species. On the Pacific coast there are several kinds of gophers. Sir John Richardson's *G. Douglasii* was 6¼ in. long, with a tail nearly three inches, cheek pouches large, resembling the thumb of a glove, hanging down by the side of the head. When in the act of emptying its pouches the animal sits on its hams, like a marmot, or squirrel, and squeezes the sacks against his breast with his chin and fore paws. These little animals are numerous about fort Vancouver, where they burrow in the sides of sand-hills, feeding on acorns and other nuts, grass, buds, potatoes, and other root crops of the farmers. There are other species in America which are called, in the localities where they abound, gophers, or gauffres. All those not inhabiting warm climates hibernate. There are many similar animals in various parts of the world, having the same habits, such as the coast rat, or cape rat, or brant, of the Cape of Good Hope, which undermines the ground to an extent which makes it dangerous to ride over it on horseback, and difficult to proceed on foot. The jumping mice, or jerboas, of which the gerbo, or Egyptian jerboa may be considered as the type, now placed in another family (*dipodidæ*), would naturally, in this country, come under the name of gopher, and the same may be said of the marmots, now placed in still another family with the squirrels (*Sciuridæ*), for the Alpine marmot is about as gopher-like in its habits as any of the animals so named. See RODENTIA.

GO'PHER WOOD. The probable identity of the gopher wood of Scripture with the cypress (q.v.), is maintained partly on account of the qualities of the wood, and partly on account of the agreement of the radical consonants of the names.

GÖP'PINGEN, a small t. of the kingdom of Würtemberg, is situated on the right bank of the Fils, 27 m. n.w. from Ulm, and is a station on the railway from Ulm to Stuttgart. It is an industrious, cleanly, and flourishing town, possessing a town-hall, a large castle, and mineral baths, and carrying on manufactures of woolen cloth, earthenwares, and some trade in wool. Pop. '75, 9,532.

GORAKHPUR, a district of the north-western provinces, India, between 26° 50' and 27° 28' n. lat., and between 83° 7' and 84° 29' e. long., bounded on the n. by the territory of Nepaul, on the e. by Champáran and Sáran, on the s. by the Gogra river, and on the w. by Basti and Fyzabad, with an area of 4,578 sq. miles. The district lies immediately s. of the lower Himalayan slopes, but forms itself a portion of the great alluvial plain. Only a few sand hills break the monotony of its level surface, which is,

however, intersected by numerous rivers studded with lakes and marshes. In the n. and center dense forests abound, and the whole country presents a verdant appearance. The principal rivers are the Rapti, the Gogra, the great and little Gandak, the Kuána, the Rolim, the Ami, and the Gunghí. The tiger is found in the n., and many other wild animals abound throughout the district. The lakes are well stocked with fish. The pop., which in 1853 numbered 1,816,390, had risen to 2,019,361 in 1872. Of these, 1,819,445 or 90.1 per cent are Hindus, 199,372 Mussulmans, and 533 Christians. The district contains a total cultivated area of 2,621 sq.m., with 897 sq.m. available for cultivation, most of which is now under forest. The chief productions are cotton, rice, *bájra, jodh, moth*, and other food-stuffs.

Gautama Buddha, the founder of the religion bearing his name, died within the district of Gorakhpur. It thus became the head-quarters of the new creed, and was one of the first tracts to receive it. The country from the beginning of the 6th c. was the scene of a continuous struggle between the Bhars and their Aryan antagonists, the Rahtors. About 900, the Domhatárs or military Bráhmins appeared, and expelled the Rahtors from the town of Gorakhpur, but they were also soon driven back by other invaders. During the 15th and 16th centuries, after the district had been desolated by incessant war the descendants of the various conquerors held parts of the territory, and each seems to have lived quite isolated, as no bridges or roads attest any intercourse between them. Towards the end of the 16th c., Mussulmans occupied Gorakhpur town, but they interfered very little with the district, and allowed it to be controlled by the native rájás. In the middle of the 18th c. a formidable foe, the Banjáras from the w., kept the district in a state of terror, and so weakened the power of the rájás that they could not resist the fiscal exactions of the Oudh officials, who plundered and ravaged the country to a great extent. The district formed part of the territory ceded by Oudh to the British under the treaty of 1801. During the mutiny it was lost for a short time, but under the friendly Gurkáhs the rebels were driven out, and the whole district once more passed under British rule.

GORAL (*antilope goral*, or *Nemorhedus goral*), an animal of the antelope family, inhabiting in large herds the elevated plains of Nepaul. It is of a grayish-brown color, dotted with black, the cheeks white; the hair is short; the horns are short, inclined, recurved, and pointed. It is a wild and fleet animal, and when pursued, takes refuge in rocky heights. Its flesh is highly esteemed.

GORAMY, or GOURAMI (*osphromenus olfax*), a fish of the family *anabasidæ* or *labyrinthibranchidæ*, a native of China and the eastern archipelago, highly esteemed for the table, and which has on that account been introduced into Mauritius, Cayenne, and the French West India islands. Its form is deep in proportion to its length, the head small, and terminating in a rather sharp short snout, the mouth small, the tail rounded, the dorsal and anal fins having numerous rather short spines, the first ray of the ventral fins extending into a very long filament. It is sometimes kept in large jars by the Dutch residents in Java, and fed on water-plants. It was introduced into Mauritius about the middle of the 18th c., and soon spread from the tanks in which it was at first kept into the streams, multiplying abundantly. The success which has attended the introduction of this fish into countries remote from those in which it is indigenous, holds out great encouragement to other attempts of the same kind. The goramy is interesting also on other accounts. It is one of the nest-building fishes, and at the breeding season forms its nest by entangling the stems and leaves of aquatic grasses. Both the male and female watch the nest for a month or more with careful vigilance, and violently drive away every other fish which approaches, till the spawn is hatched, afterwards affording a similar parental protection to the young fry.

GORDIAN KNOT. The traditional origin of this famous knot was as follows: Gordius, a Phrygian peasant, was once plowing in his fields, when an eagle settled on his yoke of oxen, and remained till the labor of the day was over. Surprised at so wonderful a phenomenon, he sought an explanation of it, and was informed by a prophetess of Telmissus that he should offer sacrifice to Zeus. He did so, and out of gratitude for the kindness shown him, married the prophetess, by whom he had a son, the famous Midas. When Midas grew up, disturbances broke out in Phrygia, and the people sent messengers to the oracle at Delphi, to ask about choosing a new king. The messengers were informed that a king would come to them riding on a car, and that he would restore peace. Returning to Phrygia, they announced these things, and while the people were talking about them, Gordius, with his father, very opportunely arrived in the requisite manner. He was immediately elected king, whereupon he dedicated his car and yoke to Zeus, in the acropolis of Gordium (a city named after himself), the knot of the yoke being tied in so skillful a manner, that an oracle declared whoever should unloose it would be ruler of all Asia. When Alexander the great came to Gordium, he cut the knot in two with his sword, and applied the prophecy to himself.

GORDIA'NUS, the name of three Roman emperors, father, son, and grandson.—The first, MARCUS ANTONIUS GORDIANUS, was grandson of Annius Severus, and was descended by the father's side from the famous family of the Gracchi. He was remarkable for his attachment to literary pursuits. After being ædile, in which capacity he celebrated the gladiatorial sports with great magnificence, he twice filled the office of

consul, first as the colleague of Caracalla, in 213 A.D.; and second, as the colleague of Alexander Severus. Soon afterwards, he was appointed proconsul of Africa, where he gained the affections and esteem of the people by his modest and gentle manners, his splendid liberality, and his refined literary taste; his old age was spent in the study of Plato, Aristotle, Cicero, and Virgil. The tyranny and injustice of the emperor Maximinus having at length excited a rebellion against his authority in Africa, the imperial procurator there was murdered by a band of nobles who had formed a conspiracy against him on account of his cruelty. Gordianus, now in his 80th year, was proclaimed emperor, after having vainly refused the dangerous honor. He received the title of *Africanus*, and his son was conjoined with him in the exercise of imperial authority. The Roman senate acknowledged both, and proclaimed Maximinus, then absent in Pannonia, an enemy to his country. The younger Gordianus, however, was defeated in battle by Capellianus, viceroy of Mauritania, before Carthage, and his father, in an agony of grief, put a period to his own existence, having been emperor for little more than a month. In his personal appearance Gordianus is said to have greatly resembled Augustus.—MARCUS ANTONIUS GORDIANUS, grandson of the preceding, was raised to the dignity of Cæsar along with Pupienus Maximus and Balbinus, who were also elected emperors in opposition to Maximinus; and, in the same year, after all three had fallen by the hands of their own soldiers, Marcus Antonius was elevated by the Prætorian bands to the rank of Augustus. Assisted by his father-in-law, Misitheus, a man distinguished for his wisdom, virtue, and courage, whom he made prefect of the Prætorians, he marched, in the year 242, into Asia, against the Persians, who, under Shahpûr (Sapor), had taken possession of Mesopotamia, and had advanced into Syria. Antioch, which was threatened by them, was relieved by Gordianus, the Persians were obliged to withdraw from Syria beyond the Euphrates, and Gordianus was just about to march into their country, when Misitheus died. Philip the Arabian, who succeeded Misitheus, stirred up dissatisfaction in the army against Gordianus by the falsest treachery, and finally goaded on the ignorant and passionate soldiery to assassinate the emperor, 244 A.D. But knowing the great affection which the Roman people had for the gallant and amiable Gordianus, he declared in his dispatch to the senate that the latter had died a natural death, and that he himself had been unanimously chosen to succeed him.

GOR'DIUS, a genus of *annelida*, of the very simplest structure; very much elongated and threadlike, with no greater marks of articulation than slight transverse folds, no feet, no gills, no tentacles, although there is a knotted nervous chord. The mouth is a mere pore at one end of the animal; the other end or tail is slightly bifid, and has been often mistaken for the head. The species inhabit moist situations, are sometimes found on the leaves of plants, but more frequently in stagnant pools, and in mud or soft clay, through which they work their way with great ease. They often twist themselves into complex knots, whence their name gordius, from the celebrated *Gordian knot*—and many of them are sometimes found thus twisted together; but they are also often to be found extended in the water. The most common species in Britain is *G. aquaticus*, of which the popular name is HAIR EEL; and a notion still prevails in many parts of the country, that it is nothing else than a horse-hair, which has somehow acquired life by long immersion in water, and which is destined in due course of time to become an eel of the ordinary kind and dimensions; in proof of all which many an honest observer is ready to present himself as an eye-witness who has often seen these very slender eels in his walks. A popular notion prevails in Sweden, that the bite of the gordius causes whitlow. When the pools in which the gordius lives are dried up, it becomes shriveled, and apparently lifeless, but revives on the application of moisture. The Abbé Fontana kept one in a drawer for three years, and although perfectly dry and hard, it soon recovered vigor on being put into water. Gordii are extremely common in the Thames.

GORDON, a co. in n.w. Georgia, on the Oostenaula river, traversed by the Selma, Rome, and Dalton, and the Western and Atlantic railroads; 420 sq.m.; pop. '70, 9,268 —1,536 colored. The surface is rough, and forests cover a large portion. Soil fertile, producing corn, wheat, pork, and hay. Co. seat, Calhoun.

GORDON, THE FAMILY OF. The origin of this great Scottish historical house is still wrapped in some measure of obscurity. Uncritical genealogists of the 17th c. affected to trace its descent from a mythical high constable of Charlemagne, a duke of Gordon, who, it was said, flourished about the year 800, and drew his lineage from the Gordoni, a tribe which, taking its name from the town of Gordunia, in Macedonia, had settled in Gaul before the days of Julius Cæsar. These fables and fancies have long ceased to be believed. Nor is more credit given to the conjecture that the family, having carried its name from Normandy to England in the train of the conqueror, soon afterwards passed on from England to Scotland. No proof has been found of any connection between the Gordons of France and the Gordons of Scotland. There is little or no doubt now that the Scottish Gordons took their name from the lands of Gordon in Berwickshire. Their earliest historian, writing in the 16th c., says that these lands, together with the arms of three boars' heads, were given by king Malcolm Ceanmohr (1057–93 A.D.) to the progenitor of the house, as a reward for slaying, in the forest of Huntly, a wild boar, the terror of all the Merse. But in the 11th c. there were neither

heraldic bearings in Scotland nor Gordons in Berwickshire. The first trace of the family is about the end of the 12th c., or the beginning of the 13th c., when it appears in record as witnessing charters by the great earls of March or Dunbar, and as granting patches of land and rights of pasturage to the monks of Kelso. About a century afterwards it enters the page of history in the person of sir Adam of Gordon. He is found in 1305 high in the confidence of king Edward I. of England, holding under that prince the office of joint justiciar of Lothian, and sitting in the English council at Westminster as one of the representatives of Scotland. He seems to have been among the last to join the banner of Bruce, who rewarded his adherence, tardy as it was, by a grant of the northern lordship of Strathbogie. The grant failed of effect at the time; but it was renewed by king David II. in 1357, and by king Robert II. in 1376. Under this last renewal, sir John of Gordon, the great grandson of sir Adam, entered into possession, and so transferred the chief seat and power of the family from the Merse and Teviotdale to the banks of the Dee, the Deveron, and the Spey. Its direct male line came to an end in his son sir Adam, who fell at Homildon in 1402, leaving an only child, a daughter, to inherit his lands, but transmitting his name through two illegitimate brothers—John of Gordon of Scurdargue, and Thomas of Gordon of Ruthven—to a wide circle of the gentry of Mar, Buchan, and Strathbogie, who, calling themselves "Gordons," styled the descendants of their niece "Seton-Gordons."

LORDS OF GORDON AND BADENOCH, EARLS OF HUNTLY, MARQUISES OF HUNTLY, AND DUKES OF GORDON.—Elizabeth of Gordon, the heiress of sir Adam, married before 1408 Alexander of Seton (the son of sir William of Seton), who, before 1437, was created lord of Gordon. Their son Alexander, who took the name of Gordon, was made earl of Huntly in 1445, and lord of Badenoch a few years afterwards. He acquired by marriage the baronies of Cluny, Aboyne, and Glenmuick in Aberdeenshire; and had grants from the crown of the Highland lordship of Badenoch, and of other lands in the counties of Inverness and Moray. He died in 1470, and was succeeded by his second son George, the second earl, who married Annabella, daughter of king James I., and added to the territories of his house the lands of Schivas in Aberdeenshire, and the Boyne, the Enzie, and Netherdale in Banffshire. He was chancellor of Scotland from 1498 to 1502, and dying soon afterwards, was succeeded by his son Alexander, the third earl, who enlarged the family domains by the acquisition of Strathaven (or Strathdoun) in Banffshire, and of the Brae of Lochaber in Inverness-shire. He commanded the left wing of the Scottish army at Flodden; and, escaping the carnage of that disastrous field, survived till the year 1524. He was succeeded by his grandson George, the fourth earl, under whom the family reached, perhaps, its highest pitch of power. He added the earldom of Moray to its already vast possessions, and long held the great offices of lieutenant of the north and chancellor of the realm. He had the repute of being the wisest, the wealthiest, and the most powerful subject in Scotland. The crown, it is said, was counseled to clip his wings, lest he should attempt, like the Douglases in the previous age, to awe or overshadow the throne. He was stripped of the earldom of Moray, and, rushing into revolt, was routed and slain at Corrichie in 1562. Sentence of forfeiture was pronounced upon his corpse, but it was rescinded in 1567, and his son George succeeded as fifth earl. He died in 1576. The family had stood aloof from the reformation, and his son and successor, George, the sixth earl, was conspicuous as the head of the Roman Catholic power in Scotland. He defeated a Protestant army sent against him under the earl of Argyle in 1594; but submitting to the king, obtained an easy pardon, and was made marquis of Huntly in 1599. He died in 1636, leaving a character of which we have an instructive sketch by a neighbor and contemporary. "This mighty marquis," says the northern annalist, John Spalding, "was of a great spirit, for in time of troubles he was of invincible courage, and boldly bore down all his enemies triumphantly. He was never inclined to war nor trouble himself; but by the pride and insolence of his kin, was diverse times drawn in trouble, which he bore through valiantly. He loved not to be in the laws contending against any man, but loved rest and quietness with all his heart; and in time of peace, he lived moderately and temperately in his diet, and fully set to building and planting of all curious devices. A well set neighbor in his marches, disposed rather to give nor take a foot of ground wrongously. He was heard to say he never drew sword in his own quarrel. In his youth, a prodigal spender; in his elder age, more wise and worldly, yet never counted for cost in matters of credit and honor; a great householder; a terror to his enemies, whom, with his prideful kin, he ever held under great fear, subjection, and obedience. He was mightily envied by the kirk for his religion, and by others for his greatness, and had thereby much trouble." We mark a new social stage when we are told that he was the first head of his house who "bought" land. His son George, the second marquis, distinguished himself by the zeal with which he espoused the royal cause in the great civil war of his time. "You may take my head from my shoulders," he said, in answer to tempting offers from the covenanters, "but not my heart from the king." Such was the state he kept, that when he took up house in Aberdeen in 1639, he was attended daily by 24 gentlemen, of whom three were of the rank of barons, while eight gentlemen were charged with the watch of his mansion by night. He was beheaded at Edinburgh in 1649, and was succeeded by his son Lewis, the third marquis, who died in 1653. The family possessions had been impaired by war and forfeiture, but it appears

that they still sufficed, in 1667, to yield £24,771 Scots a year to his son George, the fourth marquis, who was made duke of Gordon in 1684. He held out the castle of Edinburgh for king James at the revolution; and dying in 1716, was succeeded by his son Alexander, the second duke, who died in 1728. He was the last Roman Catholic chief of his race, and, as we are told by Boswell, lived "in sequestered magnificence, corresponding with the grand dukes of Tuscany," with whom he believed that he could count kindred. He never traveled in the north without a train of his vassals on horseback. His son, Cosmo George, the third duke, died in 1752, leaving three sons. The youngest, lord George Gordon, led the Protestant mob which sacked London in 1780; the eldest, Alexander, the fourth duke, died in 1827, being succeeded by his son George, the fifth duke, on whose death, without issue, in 1836, the title of duke of Gordon (being limited to the heirs-male of the body of the first duke) became extinct, the title of earl of Huntly fell into abeyance, and the title of marquis of Huntly was adjudged to the earl of Aboyne, as heir-male of the body of the first marquis. The estates went to the duke's nephew, Charles, fifth duke of Richmond and Lennox, grandson of the fourth duke of Gordon, and his wife, the sprightly Jane Maxwell, daughter of sir William Maxwell of Monreith. The title of duke of Gordon was revived in 1876 in the person of the sixth duke of Richmond.

VISCOUNT OF MELGUND, VISCOUNTS OF ABOYNE, EARLS OF ABOYNE, AND MARQUISES OF HUNTLY.—Lord John Gordon, second son of the first marquis of Huntly, was made viscount of Melgund and lord Aboyne in 1627. Three years afterwards, he was burned to death in the tower of Frendraught. In 1632, his elder brother, George, was made viscount of Aboyne, and on his succession to the marquisate of Huntly in 1636, the title of viscount of Aboyne devolved on his third son, who distinguished himself on the king's side during the wars of the covenant, and died, it is said, of a broken heart, a few days after the execution of Charles I., in 1649. Lord Charles Gordon, third son of the second marquis of Huntly, was made earl of Aboyne in 1660. His great-great-grandson, George, who had been a favorite at the court of Marie Antoinette, succeeded as fifth earl of Aboyne in 1794, on the death of his father, and as eighth marquis of Huntly in 1836, on the death of the fifth duke of Gordon.

EARLS OF SUTHERLAND.—About the year 1512, Adam Gordon of Aboyne, second son of the second earl of Huntly, married Elizabeth, the heiress of Sutherland, and in her right became earl of Sutherland. Neither he nor his wife, it appears, could write their own names. Their descendants, the earls of Sutherland, continued to bear the surname of Gordon through six or seven generations, till the beginning of the 18th c. when they exchanged it for the surname of Sutherland, which had been borne by the countess Elizabeth before her marriage with Adam Gordon.

LORDS OF LOCHINVAR AND VISCOUNTS OF KENMURE.—William of Gordon, the second son of sir Adam of Gordon, who figured in the reign of king Robert I. (1306–1329), had a grant from his father of the barony of Stitchel, in Teviotdale, and of the lands of Glenkens, in Galloway. He was the progenitor of the knightly family of Lochinvar, which in 1633 was raised to the peerage by the titles of lord of Lochinvar and viscount of Kenmure. William, the sixth viscount,—the *Kenmure's on and awa'* of Jacobite song,—was beheaded in 1716 for his share in the rising of the previous year. The peerage, which was then forfeited, was restored in 1824, but has been in abeyance since the death of Adam, the ninth viscount, in 1847.

EARLS OF ABERDEEN.—Some genealogists have sought to engraft this branch upon the parent stem before it was transplanted to the n. towards the end of the 14th century. But no evidence has been produced in support of this claim; and modern research holds by the old tradition, that the house descends from one of the illegitimate brothers of sir Adam of Gordon, who was slain at Homildon in 1402. His first possession seems to have been Methlic on the banks of the Ythan. Patrick Gordon of Methlic fell under the banner of the earl of Huntly at the battle of Arbroath in 1445. His son and successor was of sufficient mark to obtain the bishopric of Aberdeen for one of his younger sons in 1516. The family reached the rank of lesser baron in 1531, and the dignity of knight-baronet in 1642. Its chief, at this last date—sir John Gordon of Haddo—one of the most gallant of the northern cavaliers, was the proto-martyr of his party, the first of the royalists who suffered death by a judicial sentence. He was beheaded at the cross of Edinburgh by the covenanters in 1644, bequeathing the name of "Haddo's Hole" to one of the aisles of St. Gile's church, which had been his prison. His son, sir George Gordon of Haddo, after distinguishing himself at the university and the bar, was made a lord of session in 1680, lord president of the court in 1681, and lord chancellor in the following year. He was raised to the peerage in 1682, by the titles of earl of Aberdeen, viscount of Formartine, lord Haddo, Methlic, Tarves, and Kellie. He died in 1720, with the character of being "a solid statesman, a fine orator, speaking slow but strong." Some of these lineaments, it has been thought, reappeared, with his love of letters, in his great-great-grandson, George, fourth earl of Aberdeen, who died in 1860, after holding the office of prime minister of the united kingdom from Dec., 1852 to Feb., 1855.

The history of the Gordons was written in the middle of the 16th c., at the request of the fourth earl of Huntly, by an Italian monk, who found his way to the Cistercian monastery of Kinloss, in Moray. His work, which has not yet been printed, is entitled,

Historiæ Compendium de Origine et Incremento Gordoniæ Familiæ, Johanne Ferrerio, Pedemontano, authore, apud Kinlos A.D. 1545, *fideliter collectum.* A century later, the Gordons found another and abler historian in a country gentleman of their own race, the excellent and accomplished Robert Gordon of Straloch, who died in 1661, before he had completed his *Origo et Progressus Familiæ Illustrissimæ Gordoniorum in Scotia.* It is still in manuscript. *A History of the Ancient, Noble, and Illustrious Family of Gordon,* by William Gordon, of Old Aberdeen, was published at Edinburgh in 1726–'27, in 2 vols. 8vo. *A Concise History of the Ancient and Illustrious House of Gordon,* by C. A. Gordon, appeared at Aberdeen, in 1 vol. 12mo, in 1754. The chief value of both books is now in their rarity. A work of much greater merit is the *Genealogical History of the Earldom of Sutherland,* or, as its author called it, "The Genealogie and Pedigree of the most Ancient and Noble Familie of the Earles of Southerland, wherein also many Particulars are related touching the Surname of Gordoun and the Family of Huntly." This was published at Edinburgh in 1813, in one vol. fol. It was written in 1639 by sir Robert Gordon of Gordonstoun, the fourth son of the twelfth earl of Sutherland by his marriage with that lady Jane Gordon (daughter of the fourth earl of Huntly), who was divorced from the infamous earl Bothwell, in order that he might marry Mary, queen of Scots. Along with sir Robert Gordon's work, there is printed a continuation of it to the year 1651, by Gilbert Gordon of Sallach. We learn from this sequel that the house of Gordon of Gight (claiming descent from a younger son of the second earl of Huntly), which gave birth, at the end of the 18th c., to the poet George Gordon, lord Byron, gave birth, at the end of the 16th c., to one of the assassins of Wallenstein, col. John Gordon, governor of Eger, in Bohemia.

GORDON, Charles George, b. England, 1833; was lieut. of engineers in 1852; served in the Crimean war, and was wounded at Sebastopol. After peace was concluded, he was employed in surveying and settling the Turkish and Russian frontier in Asia. He was engaged in the expedition against Pekin, and after all the objections raised by the Chinese government had been satisfied, he remained in the Chinese service. At the close of the year 1861 he made a journey from Pekin to the Chotow and Kalgan passes on the great wall, passing Tiayuen, a city never before visited by Europeans. In 1863 he was appointed commander of the "Ever Victorious Army," and was mainly instrumental in suppressing the formidable Tai-Ping rebellion in that and the succeeding year. He found the richest and most fertile districts of China in the hands of the most savage brigands. The silk districts more particularly were the scenes of their cruelty and riot, and the great historical cities of Hangchow and Soochow were threatened with the fate of Nanking, and were fast being reduced to ruins. Gordon relieved the great cities, dispersed the remnants of the rebel forces, and confined them to a few tracts of devastated country and their stronghold at Nanking. A detailed account of his exploits is given in Andrew Wilson's *Ever Victorious Army.* He was promoted to the rank of capt. in 1859, became maj. in 1862, and lieut.col. Feb. 16, 1864. He was nominated a companion of the Bath, Dec. 9, 1864. He was British vice-consul of the delta of the Danube, Turkey, from 1871 till 1873, when he conducted an expedition into Africa under the auspices of the khedive of Egypt, by whom he was appointed governor of the provinces of the equatorial lakes. Subsequently he was created a pasha, and in Feb., 1877, the khedive appointed him governor of the whole of Soudan.

GORDON, Lord George, celebrated in connection with the London Protestant riots of 1780, the third son of the third duke of Gordon, was b. Sept. 19, 1750. At an early age he entered the navy, and rose to the rank of lieut., but quitted the service during the American war, in consequence of a dispute with the admiralty relative to promotion. Elected in 1774 M.P. for Luggershall, one of the pocket boroughs disfranchised by the reform bill of 1832, he soon rendered himself conspicuous by his opposition to ministers, and the freedom with which he attacked all parties; but though eccentric, he displayed considerable talent in debate, and no deficiency of wit or argument. A bill having in 1778 passed the legislature for the relief of Roman Catholics from certain penalties and disabilities, the Protestant association of London was, among other societies, formed for the purpose of procuring its repeal, and in Nov., 1779, Gordon was elected its president. In June, 1780, he headed a vast and excited mob, of about 100,000 persons, which went in procession to the house of commons, to present a petition against the measure, when he addressed them in a speech calculated to inflame their passions and bigotry. Dreadful riots ensued in the metropolis, lasting for several days, in the course of which many Catholic chapels and private dwelling-houses, Newgate prison, and the mansion of the chief-justice, lord Mansfield, were destroyed. Gordon was arrested, and tried for high treason; but no evidence being adduced of treasonable design, he was acquitted. His subsequent conduct seemed that of a person of unsound mind. Having, in 1786, refused to come forward as a witness in a court of law, he was excommunicated by the archbishop of Canterbury for contempt. In 1787 he was convicted, on two official informations, for a pamphlet reflecting on the laws and criminal justice of the country, and for publishing a libel on the queen of France (Marie Antoinette) and the French ambassador in London. To evade sentence he retired to Holland, but was sent

back to England, and apprehended at Birmingham. Sentenced to imprisonment, he died in Newgate, of fever, Nov. 1, 1793. He had latterly become a proselyte to Judaism.

GORDON, JOHN B., b. Ga., 1862; graduated at the state university and followed the profession of law. Early in the war of the rebellion he joined the southern army, and rose through the various grades to that of lieut.gen. He commanded one wing of Lee's army at Appomatox. He was wounded several times during the war. In 1868 he was the democratic candidate for the governorship of Georgia, but was not elected. In 1873 he was elected to the U. S. senate.

GORDON, Sir JOHN WATSON, president of the royal Scottish academy, son of a capt. in the navy, was b. at Edinburgh about 1790. He studied for four years under John Graham, director of the academy of the trustees for the encouragement of manufacture, where he showed the usual desire of young artists to become an historical painter, but ultimately turned his attention to portraiture, in which he achieved a distinguished reputation. Gordon continued to reside in his native city. He first exhibited in the royal Scottish academy in 1827, was elected in 1841 an associate, in 1850 an academician of the London royal academy; and on the death of sir William Allan, president of the royal Scottish academy, when the honor of knighthood was conferred on him. Gordon was as national in his art as it is possible for a portrait-painter to be—that is to say, he excelled in transferring to the canvas those lineaments of character which are conceived to be pre-eminently Scotch. The shrewd, cautious, calculating countenance of the Caledonian has never been so happily rendered. Nearly every man of note in Scotland, and not a few in England, sat for their portrait to this artist. Among his best-known works may be mentioned "Sir Walter Scott" (1831); "Dr. Chalmers" (1837); "Duke of Buccleuch" (1842); "Lord Cockburn" (1842); "Thomas De Quincey" (1843); "Lord Robertson" (1846); "Principal Lee" (1847); "Professor Wilson" (1851); "Earl of Aberdeen" (1852); and "the Provost of Peterhead" (1853). The last picture, which is the property of the Merchant Maiden hospital, Edinburgh, gained for Gordon the gold medal at the French exposition of 1855, and may be as reckoned among the happiest examples of portraiture in existence in any country. He died June, 1864.

GORDON, Gen. PATRICK, one of the most distinguished of the many soldiers of fortune whom Scotland sent to the wars of Europe, was b. at Easter Auchleuchries, a bleak homestead on the eastern coast of Aberdeenshire, on March 31, 1635. His father, a "goodman" or yeoman, was a grandson of the family of Gordon of Haddo, afterwards raised to the earldom of Aberdeen. His mother, an Ogilvie, who could count kindred with the noble houses of Deskford and Findlater, was the heiress of Auchleuchries, an estate of five or six petty farms, worth in those days about £360 Scots, or £30 sterling a year, and hopelessly burdened by mortgages. In his fifth year Gordon was sent to the neighboring parish school, where he seems to have got a fair knowledge of Latin. The gates of the university were closed against him by his devotion to the Roman Catholic faith of his mother; and so at the age of 16, he resolved—to use his own words—"to go to some foreign country, not caring much on what pretense, or to what country I should go, seeing I had no known friend in any foreign place."

A ship from Aberdeen landed him at Dantzic in the summer of 1651, and some Scottish acquaintances or kinsfolks placed him at the Jesuit college of Braunsberg. His restless temper could not long endure the stillness and austerity of that retreat, and making his escape from it in 1653, he led for some time an unsettled life, until in 1655, he enlisted under the flag of Sweden, then at war with Poland. During the six years that he took part in the struggle between these two powers, he was repeatedly made prisoner, and as often took service with his captors, until again retaken. He had risen to the rank of capt.lieut., when he resolved to try his fortune next with the czar, and, in 1661, joined the Muscovite standard.

Here his services in disciplining the Russian soldiers were duly appreciated, and his rise was rapid. He was made lieut.col. in 1662, and col. in 1665. Hearing that the death of his elder brother had made him "goodman of Auchleuchries," he wished once more to return to Scotland; but he found that there was no escape from the Russian service. The czar, however, sent him on a mission to England in 1666. On his return he fell into disgrace, for what reason, does not very clearly appear. In 1670 he was sent to serve in the Ukraine against the Cossacks, and when these were subdued, he was sent back in 1677 to defend Tschigirin against the Turks and the Tartars. His gallant performance of that duty gained him high military reputation and the rank of maj.gen. In 1683 he was made lieut.gen.; and two years afterwards he obtained leave to visit England and Scotland. King James II. wished him to enter the English service; but it was in vain that he petitioned for leave to quit Russia. In 1688 he was made gen., and now began his intimacy with the czar Peter, who, in the following year, owed to Gordon's zeal and courage his signal triumph over the conspirators aginst his throne and life. Nor was this Gordon's only great service to his imperial master. In 1698 he crushed the revolt of the Strelitzes, during the czar's absence from Russia. Peter was not ungrateful, and Gordon's last years were passed in opulence and honor. He died at Moscow, in the morning of Nov. 29, 1699. "The czar," says his latest biographer, "who had visited him five times in his illness, and had been twice

with him during the night, stood weeping by his bed as he drew his last breath; and the eyes of him who had left Scotland a poor unfriended wanderer, were closed by the hands of an emperor."

Gordon kept a journal for the last 40 years of his life. It seems to have filled 8 or 10 thick quartos, of which only six are now known to exist. An abridgment of them, rendered into German, under the title of *Tagebuch des Generals Patrick Gordon*, was published at Moscow and St. Petersburg, in 3 vols. 8vo, in 1849—1851—1853, very carefully edited by Dr. Posselt. In 1859, *Passages from the Diary of General Patrick Gordon*, in the original English, edited by Mr. Joseph Robertson, were printed by the Spalding Club in 1 vol. 4to.

GORDON, WILLIAM, 1730–1807; a clergyman of England who came to Massachusetts in 1770 and was minister of the third church in Roxbury. He was for a time chaplain to the provincial congress. About 1786 he returned to England, where he published *History of Rise, Progress, and Establishment of the Independence of the United States of America*.

GORDO'NIA, a genus of trees and shrubs of the natural order *Ternstrœmiaceæ*, having five styles combined into one, which is crowned with five stigmas, a 5-celled capsule, and winged seeds. Several species are natives of America, of which the most important is the LOBLOLLY BAY (Gordonia *Lasianthus*), which is found in swamps near the sea-coast of the gulf of Mexico. Moist tracts of considerable extent are often covered with this tree alone. It attains a height of 50 or 60 ft., has oblong, leathery, evergreen leaves, and beautiful, white, sweet-scented flowers, more than an inch in diameter. The bark is much used for tanning. In England it is cultivated with some difficulty, and generally appears as a mere bush.

GORE, in heraldry, a charge consisting of one-third of the shield cut off by two arched lines, one drawn from the dexter or sinister chief, and the other from the bottom of the escutcheon, meeting in the fess point. A gore sinister is enumerated by heralds as one of the abatements or marks of dishonor borne for unknightly conduct. See GUSSET.

GORE, Mrs. CATHERINE GRACE, an English novelist, was born at East Retford, Nottinghamshire, in 1799. Her father, Mr. Moody, was a wine-merchant in moderate circumstances. In 1823 she was married to capt. Charles Arthur Gore, with whom she resided for many years on the continent, supporting her family by her literary labors. These were varied and voluminous to an extraordinary degree, amounting in all to seventy works. She died at Lynwood, Hants, Jan. 27, 1861. Her first published work was *Theresa Marchmont, or the Maid of Honor*, published in 1823. Some of her early novels, as the *Lettre de Cachet*, and the *Tuileries*, were vivid descriptions of the French revolution; but her greatest successes were her novels of English fashionable life, conspicuous among which were—*Cecil, or the Adventures of a Coxcomb*, and *Cecil, a Peer*, *The Ambassador's Wife*, *The Banker's Wife*, etc. She also wrote a prize comedy, entitled *The School for Coquettes*; *Lord Dacre of the South*, a tragedy; *Bond*, a dramatic poem; and other poetical and descriptive works.

GORE, CHRISTOPHER, 1758–1827; b. Boston; a graduate of Harvard, and a lawyer. He was the first U. S. district attorney for Massachusetts and contributed largely, as one of the commissioners, to the settlement of the claims of this country upon Great Britain. He was governor of his state in 1809, and U. S. senator 1814–17. He bequeathed the greater part of his property to Harvard college.

GORE'E, a very small island, belonging to the French, situated immediately s.e. of Cape Verd, on the western coast of Africa. It is only about three miles in circumference, contains a town defended by a fort, and covering two-thirds of the entire surface of the island. It is considered by the French as an important commercial entrepôt; its exports are gold-dust, ivory, wax, etc. Population of the island about 7,000; of the town, 3,000.

GO'REY, a small municipal borough and market-town of Ireland, in the county of Wexford, is situated about 24 miles n.n.e. of the town of that name, and three miles inland from the coast of St. George's channel. It is an old town, having received its charter of incorporation from James I., and consists mainly of one street of nearly a mile in length. Besides the national school and the savings-bank, the Roman Catholic chapel, with nunnery attached, built in the pointed style, may be mentioned. Gorey carries on a considerable trade in agricultural produce. Pop. '71, 2,639.

GORGE (Ital. *gorga*, throat), the rear-opening into any work in fortification, consists of the space between the extremities of the two sides, as between the faces of a ravelin, or between the flanks of a bastion. The demi-gorges of a bastion are lines in continuation of the curtains on each side, extending from the extremities of the flanks to the point of intersection of the lines. See also FORTIFICATION.

GORGED. When a lion or other animal has a crown by way of collar round its neck, it is said heraldically to be gorged.

GÖRGEI, ARTHUR, gen. commanding-in-chief of the Hungarian army during 1848–49, was born at Toporcz, in the county of Szepes (Zips), Feb. 5, 1818, and after

a thorough military education, got a commission as lieut. in the regiment of Palatine hussars. Finding garrison-life too monotonous, and promotion slow, Görgei took leave of it, and turned a zealous student of chemistry at Prague. At the outbreak of the revolution, Görgei hastened to the seat of the first independent Hungarian ministry, offering his services, and was sent to Belgium, where he effected a purchase of arms for the new levies of honvéds. He first exhibited his great military capacity after the rout of the Hungarian army near Schwechat, when he was made a gen., and conducted the retreat that had to be effected with consummate skill and courage. His raw levies had to be kept together and drilled under the roaring cannon of the enemy; the disaffected officers, many of them foreigners, and addicted to monarchy, to be retained under the revolutionary flag; a commissariat to be organized during fatiguing marches and constant fighting. Perczel's corps was totally dispersed at Moor; government and diet were fleeing towards the Transylvanian frontier, and the dreary wilderness of the Carpathians threatened to become the tomb of all, in the midst of a winter little less severe than that which destroyed the grand army of Napoleon I. At the end of Dec. 1848, Hungary seemed to be lost; at the beginning of March, 1849, Görgei was concerting a plan for driving the enemy out of the country. After Dembinski's failure as gen.-in-chief, Görgei was declared the head of the united army corps of the n. (hitherto his own), of the Upper Theiss, under Klapka, and of Szolnok, under Damjanich. Forty thousand men, the finest army Hungary ever saw, broke forth from behind the Theiss, and drove the Austrians, with bloody losses, from one position to another. The battles of Hatvan, Bitske, Isaszeg, Gödöllö, Vácz, Nagy-Sarlo, were a succession of triumphs. Pesth was evacuated by the enemy, the siege of Komorn was raised, and before the month of April was over, nothing was left in the enemy's hands except a small strip on the western frontier, and the impregnable fastnesses which surround Tittel on the Lower Theiss. Buda, the ancient capital of the realm, well fortified and garrisoned, was to be stormed, and for this the victorious campaign had to be inter rupted. The delay was fatal. Russian armies hastened to the rescue of Austria, and regiments of veterans was dispatched by Radetzky, the war in Italy being nearly over. The fortress of Buda was carried on May 21, but the flower of the Hungarian infantry was buried among its ruins. In the latter part of June, the Austro-Russian army, under Haynau and Panjutine, beat Görgei near Zsigard; and the affair at Györ (Raab) resulted in the retreat of the Hungarians close to the walls of the fortress of Komorn. On July 2, a bloody battle was fought near Szöny, where Görgei gave proofs of indomitable courage. On July 16, a desperate fight took place in and near Vácz between Russians and Hungarians. Görgei, after some weeks, arrived in the neighborhood of Arad with an army decimated by continual fighting, by heavy marches, and by dysentery. At Debreczin the corps of Nagy-Sándor was sacrificed in order to allow an agonizing march of a few days. On Aug. 9, the lower army, under Dembinski, was annihilated in the battle of Temesvár, and on the 10th, Görgei was declared dictator by a council held in the fortress of Arad, under the presidency of Kossuth. But further resistance on the part of the Hungarians was now hopeless, and on the 13th Görgei's army surrendered at Világos to prince Paskiewitch, com.-in-chief of the Russian forces. This surrender has been often imputed as treachery to Görgei. Whether such an imputation is excusable, may be best judged from the circumstance, that on the day of surrendering Görgei had 24,000 men with 140 cannon, and that five armies, with more than 200,000 men and 1,000 cannon, were closing upon him from different directions. Görgei was confined to Klagenfurt, whence he was released on parole, and engaged in chemical studies. In 1852 he published a work at Leipsic (a translation of which appeared at London in the same year), under the title, *Mein Leben und Wirken in Ungarn in den Jahren* 1848 *und* 1849; and in 1869 *Hungary in* 1849 *and after* 1866.

GORGES, Sir Ferdinando, lord proprietary of the province of Maine; b. in Somersetshire, England, at a date unknown, d. at an advanced age in 1647. He was engaged in the conspiracy led by the earl of Essex, against whom he was a witness in the trial of 1601. After serving for a time in the English navy, he was in 1604 appointed governor of Plymouth. Becoming deeply interested in the settlement of the new world, he resolved to become a proprietor of some part of its territory. Popham, the lord chief-justice of England, was persuaded to join him. In 1606 the king incorporated the London and Plymouth colonies, dividing between them the American territory, extending 50 m. inland from the 34th to the 45th parallel n. latitude. The Plymouth colony had the northern half, under the name of Northern Virginia. On May 31, 1607, three ships with 100 emigrants sailed from Plymouth, England. They landed at the mouth of the Kennebec, Maine, where they began a settlement, which, however, they were soon obliged to abandon. Capt. John Smith, as agent for Gorges, made several unsuccessful attempts to establish other settlements; but in 1616 Gorges sent out a small party which encamped for the winter on the river Saco. In 1620 Gorges and his associates obtained a new charter for the "Governing of New England in America," which gave them title to the territory extending westward from the Atlantic to the Pacific, between the 40th and 48th parallels n. latitude. Gorges and John Mason took grants of the district called Laconia, lying between the Merrimack and the Kenne-

bec, and extending from the Atlantic to the "river of Canada," and under the auspices of the former, several settlements were made. In 1623 capt. Robert Gorges, son of Ferdinando, was appointed by vote of the council for New England, "general governor of the country." Twelve years later, however, the council resigned the charter to the king, the elder Gorges expecting to be thereupon appointed governor general. Disappointed in this, he induced the king to grant him a charter constituting him lord proprietary of the province of Maine, and providing that his office should remain hereditary in his family. His son Thomas was sent out as deputy governor. The principal settlements were Agamenticus and Saco, the former being the place now called York, and which was chartered as a city in 1642 under the name of Gorgeana. In 1643 the four New England colonies formed an alliance for mutual defense, excluding therefrom the Gorges settlements, because, as Winthrop says, "They ran a different course from us both in their ministry and civil administration," and furthermore because the "lord proprietary of the province of Maine" was then fighting in England for the king against the cause of the Puritans. After the death of Gorges the settlements established by him formed themselves into a body politic and submitted to the jurisdiction of Massachusetts. His grandson, Ferdinando, born in 1629, received from Massachusetts the sum of £1,250 for relinquishing his rights as an heir to the province of Maine. This grandson was the author of *America Painted to the Life*, published in London in 1659.

GOR'GET (Ital. *gorgietta*, from *gorga*, a throat), that part of the ancient armor which defended the neck.—Also a crescent-shaped ornament formerly worn by military officers on the breast.

GORGET (Fr. *gorgeret*, from *gorge*, the throat), a surgical instrument, or rather a series of surgical instruments, devised to facilitate the operation of lithotomy (q.v.). They are now almost entirely out of use.

GOR'GIAS, a celebrated Greek rhetorician, of the time of Socrates, was b. at Leontini, in Sicily, and settled in Greece, residing for the most part at Athens, and at Larissa in Thessaly. He died at the age of 105 or 109. Gorgias has been immortalized by Plato in a dialogue which bears his name. Two works attributed to him are extant, *The Apology of Palamedes* and the *Encomium on Helena*, but their genuineness has been disputed by several critics. Gorgias displayed little aptitude for theorizing on the art which he professed to teach, and was not remarkable for speculative acumen generally, but he would appear to have been a quick and judicious *observer*. He avoided, according to Plato, general definitions of virtue and morality, but, on the other hand, Aristotle notices that he had a true appreciation of the facts of morality, as they are manifested in life and character, and the picture given of him by Plato is in harmony with this remark. He did not wish to be thought a *sophist*, but only a *rhetorician*, and the ancients were in fact at a loss whether to consider him the latter or both.

GOR'GO, or GORGON, according to Homer, a frightful monster inhabiting the infernal regions, the head of which was peculiarly appalling. Homer and Euripides make mention of only one gorgo, the daughter of Terra, who was slain by Minerva, while Hesiod mentions three gorgones—Stheno, Euryale, and Medusa, the daughters of Phorcys and Ceto, for which reason they are called likewise the Phorcides. Their habitation, according to the same author, was in the Western ocean, in the neighborhood of Night and the Hesperides; while Herodotus and other later writers place it in Libya. They are represented as girded with serpents with heads erect, vibrating their tongues, and gnashing their teeth. Æschylus describes them as winged virgins with brazen claws, and enormous teeth, having two serpents round their bodies by way of girdle. The name gorgo was given more especially to Medusa. According to later legends, Medusa was originally a very beautiful maiden, and the only one of the three sisters who was mortal. But she having become a mother by Neptune in one of Minerva's temples, that virgin goddess was so affronted that she changed Medusa's hair into serpents, which gave her so fearful an appearance that whoever looked on her was turned into stone. Medusa was killed by Perseus (q.v.), and her head was afterwards placed in the shield of Minerva. Various explanations have been given of the myth both by the ancients and the moderns, but no one in particnlar can be said to be satisfactory.—Compare Levezow, *Ueber die Entwickelung des Gorgonenideals in der Poesie und bildenden Kunst der Alten* (Berlin, 1833).

GORGONA, a small island in the Pacific, about 30 m. from the w. coast of South America, in 2° 51′ n. lat.: 78° 4′ w. long.; 6 by 2 miles. Portions of the surface rise 2,000 ft. above the tide. It was once the haunt of pirates, and it is said that Pizarro landed on the island just before he made his attack on Peru.

GORGO'NIA, a genus of zoophytes (*anthozoa*), allied to *alcyonium* (q.v.). The whole structure (polype-mass) is rooted and branching, consisting of a horny central axis with a polypiferous flesh, which when dried becomes a friable crust full of calcareous spicules. The hard stem is composed of concentric layers, probably formed in succession by consolidation of the fleshy substance. The stem is usually brown or black, whilst the flesh, or even the dried crust, often exhibits colors of great brilliancy. The polypes have eight tentacles. Several species of gorgonia are rare British zoophytes; but the species most generally known is *gorgonia flabellum*, or the *flabellum veneris*, also called

the sea-fan, a tropical species, often brought home as a curiosity from the West Indies, which exhibits in a striking manner the flat shape, more or less characteristic of this genus, and of the family *gorgoniadæ*.

GORHAM, a village in Coos co., N. H., and in Gorham township, on the Grand Trunk railroad, about 10 m. n.e. of Mount Washington. The township had 1,167 pop. in 1870. The village is delighfully situated and is much frequented by summer visitors.

GOR'HAM CONTROVERSY. The Gorham controversy arose out of the refusal of Henry Philpott, bishop of Exeter, to institute the Rev. Cornelius Gorham, formerly fellow of Queen's college, Cambridge, and then vicar of St. Just-in-Penrith, to the vicarage of Brampford Speke, on his presentation thereto by the lord chancellor. The alleged ground of this refusal was, that after examination the bishop found Mr. Gorham to be of unsound doctrine as to the efficacy of the sacrament of baptism, inasmuch as he held that spiritual regeneration is not given or conferred in that sacrament, and in particular, that infants are not made therein "members of Christ and the children of God," as the catechism and formularies of the church declare them to be. The case was brought before the Arches court of Canterbury, which decided (1849) that baptismal regeneration is the doctrine of the church of England, and that Mr. Gorham maintained doctrines on the point opposed to those of the church, and that consequently the bishop had shown sufficient cause for his refusal to institute, and that the appeal must be dismissed with costs. From this decision, Mr. Gorham appealed to the judicial committee of privy council. The committee complained that the bishop's questions were intricate and entangling, and that the answers were not given plainly and directly. Their decision was in substance as follows; and it must be noted what points they undertook to decide, and what not. The court declared that it had no jurisdiction to settle matters of faith, or to determine what ought, in any particular, to be the doctrine of the church of England, its duty being only to consider what is by law established to be her doctrine upon the legal construction of her articles and formularies. It appeared that very different opinions as to the sacrament of baptism were held by the promoters of the reformation; that differencs of opinion on various points left open were always thought consistent with subscription to the articles; and also, that opinions in no important particular to be distinguished from Mr. Gorham's had been maintained without censure by many eminent prelates and divines. Without expressing any opinion as to the theological accuracy of Mr. Gorham's opinions, the court decided that the judgment of the Arches court should be reversed. Mr. Gorham was accordingly instituted to Brampford Speke. During the two years that the suit was pending, the theological question was discussed with all degrees of ability and acrimony in sermons and pamphlets; and it was expected that if the judgment had gone the other way, a large body of the evangelical clergy, who for the most part hold views more or less in accordance with those of Mr. Gorham, would have seceded from the church.

GORHAM CONTROVERSY. See RITUALISM, *ante*.

GORICA, a t. of the Austrian empire, in Croatia, 10 m. s.s.e. from Agram, in the valley of the Save. Pop. 7,902.

GORIL'LA (*troglodytes gorilla*), a great African ape, generally referred by naturalists to the same genus with the chimpanzee, although prof. Isidore Geoffroy St. Hilaire has attempted to establish for it a separate genus. It has received the name by which it is now known in consequence of its being supposed to be the same animal which is mentioned in the "Periplus" of Hanno the Carthaginian navigator, who visited the tropical parts of the west coast of Africa about the year 350 B.C., although it is by no means certain that the gorilla of Hanno is not the chimpanzee. Vague accounts of apes of great size, and of which very wonderful stories were told, were from time to time brought from Western Africa; but it was not till 1847 that the gorilla became really known to naturalists, when a skull was sent to Dr. Savage of Boston by Dr. Wilson, an American missionary on the Gaboon river. Since that time, not only have skeletons and skins been obtained in sufficient number for scientific examination, but information has also been procured concerning the habits of the animal in its native haunts. The accounts of the gorilla given in Du Chaillu's *Explorations and Adventures in Equatorial Africa* (London, 1861) are regarded by the highest scientific authorities, and particularly by Owen, as in the main trustworthy, notwithstanding all the doubt that has been cast over that traveler's narrative of his adventures; and there is little doubt that they are in accordance with all that we have learned from other sources, and with the inferences to be deduced from the dentition and osteology of the animal.

The gorilla differs from the chimpanzee in its greater size; the height of an adult male in an erect posture being commonly about five ft. six in. or five ft. eight in., although there is reason to think that it sometimes exceeds six feet. Its strength appears also to be greater in proportion to its size, and even its skeleton indicates very great muscular power both in the jaws and limbs. The bony ridges in the skull above the eyes are extremely prominent; and the skull of the male also exhibits a large occipital ridge on the top of the head. The brain is small. The nasal bones project more than in the chimpanzee, thus producing an approximation to the human face, in a somewhat prominent nose. The lower part of the face, however, projects very much; and besides

that the teeth do not form a perfectly uninterrupted series as in man, the canine teeth are very large, particularly in the male, projecting considerably more than an inch from the upper jaw, much larger in proportion than in the chimpanzee; although, on the other hand, the molars bear a greater proportion to the incisors, and thus approach more to the human character. The breadth at the shoulders is great. There are thirteen pair of ribs. The pelvis approaches the human form more than in any other ape. The arms are not so long as in the chimpanzee, but reach nearly to the knee in the erect position. The lower limbs, although shorter in proportion than in man, are longer than in the chimpanzee. The foot is less turned inward than in the chimpanzee, and is better fitted for walking on the ground; the great toe is a true thumb, as in the chimpanzee, standing out from the foot at an angle of about 60°, and is remarkably large and strong. The hands or paws of the fore limbs are also remarkable for their great size, their thickness, and their strength. The fingers are short, but the circumference of the middle finger at the first joint is sometimes more than six inches.—The gorilla has a black skin, covered with short dark-gray hair, reddish brown on the head; the hair on the arms longer, that on the arm from the shoulder to the elbow pointing downwards, and that on the fore-arm pointing upwards to the elbow, where a tuft is formed. The face is covered with hair, but the chest is bare. There is scarcely any appearance of neck. The mouth is wide, and no red appears on the lips. The eyes are deeply sunk beneath the projecting ridge of the skull, giving to the countenance a savage scowl, the aspect of ferocity being aggravated by the frequent exhibition of the teeth. The belly is very large and prominent; in accordance with which character, the gorilla is represented as a most voracious feeder, its food being exclusively vegetable—partly obtained by climbing trees, and partly on the ground. It is very fond of fruits and of some leaves, as the fleshy parts of the leaves of the pine-apple; and employs its great strength of jaws and teeth in tearing vegetable substances and cracking nuts which would require a heavy blow of a hammer. It is not gregarious in its habits. It spends most of its time on the ground, although often climbing trees. It is capable of defending itself against almost any beast of prey. It has a kind of barking voice, varying when it is enraged to a terrific roar. It inhabits exclusively the densest parts of tropical forests, and is only found in regions where fresh water is abundant. It is much dreaded by the people of the countries in which it is found, although by some of the tribes its flesh is sought after for food. Many strange stories are current among them about its habits, which seem entitled to little regard—as, for example, of its carrying away men and women, and detaining them for some time in the woods—of its lying in wait on the branch of a tree till a man passes beneath, furtively stretching down one of its hinder legs to catch him, and holding him in the grasp of its foot, or rather hand, till he is strangled; and the like.—The gorilla has not been hitherto tamed, and in an adult state at least, seems very incapable of it. In 1876 a live gorilla was brought to Berlin, the first authentic instance of the introduction of the animal into Europe. The name given to this animal in its native country is *ngina*, or *ingeena*.

Du Chaillu has described, as discovered by himself, two other species of *troglodytes*, the koolokamba (*T. koolo-kamba*) and the nshiego-mbouvé (*T. calvus*), smaller than the gorilla; the latter remarkable for making an umbrella-like shelter of leaves placed against a branch to protect itself from the rain.

GORITZ. See GÖRZ, *ante*.

GORKHA, a t. of Nepaul, stands in lat. 27° 52′ n., and in long. 84° 28′ e. Originally the seat of the reigning dynasty of the country, it gives name to the dominant race—a race noted alike for fidelity and valor during the mutiny of 1857. Gorkha is 53 m. to the west of Khatmandu, the capital of the state.

GORKUM (Dutch, *Gorinchem*), a t. and fortress in the Netherlands province of S. Holland, is situated on the Merwede, where it is joined by the Linge, 22 m. e.s.e. of Rotterdam. It is well built, has a town-house, military establishments, and a trade in agricultural produce and fish, especially salmon. Ship-building, making leather, ropes, beer, book-printing, etc., are chief industries. Pop. '75, 8,982.

GÖRLITZ, a fortified t. of Prussia, in the province of Silesia, is a principal station on the railway from Dresden to Breslau, and is situated on a declivity on the left bank of the Neisse, 52 m. w. of Liegnitz. It is well built, is surrounded by old walls, and flanked with towers, the chief of which is the Kaisertrutz, now the guard-house and armory of the town. Among the many beautiful Gothic churches, the most interesting is that of St. Peter and St. Paul, built 1423–97, and having five naves, a magnificent organ, and a bell 12½ tons in weight. In the n.w. of the t. is the Kreuzkapelle (chapel of the cross), an imitation of the holy sepulcher at Jerusalem. Görlitz has also a gymnasium with an excellent library, numerous educational and benevolent institutions, and a theater. A viaduct upwards of 1500 ft. in length, and 115 ft. high, one of the grandest in the n. of Germany, here crosses the valley of Neisse. Görlitz has manufactures of cloth, leather, glass, tobacco, and machinery; has extensive weaving and bleaching, and a lively transit trade. In eight cloth factories, driven by water and steam power, 1600 workers produce nearly 20,000 pieces of cloth annually. Pop. '75, 45,348.

GÖRLITZ PROCESS is the name of a celebrated trial which took place in Germany in 1850. It was occasioned in this way: On June 13, 1847, the countess of Görlitz was strangled by a servant of her own named Johann Stauff, whom she had caught stealing some valuables from an open desk in her sitting-room, and her corpse was found a few hours after burned by a combustible stuff heaped upon her. After more than two years spent in preliminary investigation, the case was tried before the assizes at Darmstadt, March 11, 1850, and occupied a whole month. The murderer, who obstinately denied having committed the crime imputed to him, was condemned to imprisonment for life. But the scientific interest of the case arose from its having led to a discussion on the possibility of the spontaneous combustion of the human body. While the physician Von Siebold declared in favor of the possibility, the chemists Bischoff (q.v.) and Liebig (q.v.) sought to demonstrate the opposite opinion, which is generally held by scientific men. See SPONTANEOUS COMBUSTION.

GOROZA, GORO SABURO. A Japanese family of metal workers in Kioto, who for nine generations have followed the craft of bronze smiths, producing the finest quality of plain, tinted, *repoussé* and gold and silver inlaid, ornamental bronzes, and fine works of art. Nearly all Goroza bronze bears the stamp of the family name, Goro, with the contraction of the personal name of the living head of the house. Many hundred of pieces of Goroza bronze are now in the United States.

GÖRRES, JAKOB JOSEPH VON, a distinguished German author, was b. at Coblenz, Jan. 25, 1776. In common with most of the ardent youth of the time, Görres threw himself eagerly into the movement of the French revolution; became an active member of the clubs and debating societies which sprung up in all the towns upon the French border, and established a newspaper, entitled the *Red Journal*, which was the exponent of the most extreme opinions of the time. In the year 1799 he went to Paris as the chief of a deputation to negotiate the annexation of the Rhineland to the French republic, but the revolution of the 18th Brumaire put an end to this and all similar dreams. Görres returned to Germany, disgusted with politics, quietly settled down in a professorship in his native town, and devoted himself exclusively to literature for several years. His works on art, on physiology, on the laws of organism, and on the relations of faith and science, attracted much attention. In 1806 he published the first part of his well-known collection of *German Popular Legends;* and in 1808 his work on the mythology of the Asiatic nations, and a further contribntion to the legendary literature of Germany. From these studies, however, in common with the great body of the German nation, he was aroused to the hope of liberation from French tyranny, by the reverses of the French arms in the Russian expedition. Görres was not slow to appeal to the national sentiment of his countrymen in the *Rhenish Mercury*, one of the most spirit-stirring journals which Germany had ever possessed; he became, in truth, the literary center of the national movement. After the re-establishment of German independence Görres continued the career of a journalist, and addressed himself against the encroachments of domestic absolutism with the same energy with which he had denounced the tyranny of foreign occupation; until, having drawn upon himself the displeasure of the government, he was obliged to flee to France, and afterwards to Switzerland. In 1827 he gladly accepted the professorship of the history of literature in the new university just then founded at Munich by the liberal king Ludwig of Bavaria. From this date, Görres made Munich his home, and his later years were devoted to literature, and in part also to the animated religious controversies occasioned in Germany by the contests between the archbishop of Cologne and the Prussian government on the subject of mixed marriages and Hermesianism. See HERMES. In all these controversies, Görres, who was an ardent Roman Catholic, took an active and influential part. He was, if not the originator, at least the main supporter of the well-known Roman Catholic journal, the *Historisch-Politische Blätter*. His last work of importance was his *Christliche Mystik* (Ratisbon, 1836–42). He died Jan. 27, 1848. See the *Historisch-Politische Blätter*, 1848, and Herzog's *Realencyclopädie*.

GORT, a small but thriving t. of Ireland, in the province of Connaught, is prettily situated on a small stream in the county of Galway, and close to its southern boundary, 17 m. n.n.e. of the town of Ennis. Its trade is chiefly in retail. Pop. '71, 1778.

GORTON, SAMUEL, 1600–77; an English clothier who came to Boston in 1636, became involved in disputes on religious topics, went to Plymouth and began to preach; but he was looked upon as a heretic, and was banished in 1637. In Rhode Island (at Aquidneck), he was publicly whipped for scandalizing the magistrates. He found protection at Providence, with Roger Williams. Thence he went to the other side of Narraganset bay and bought the lands owned by the Indian chief Miantonomo. His claim was disputed by other Indian chiefs, and the dispute being referred to the Boston authorities, soldiers were sent, who took Gorton and ten of his people prisoners. They were tried at Boston on charge of being "damnable heretics," and sentenced to hard labor in chains. Five months afterwards they were released and driven out of the colony. Gorton then returned to England and obtained from the earl of Warrick an order for the land he had bought from the sachem. He named the place Warrick, and henceforward lived in peaceful possession. He preached occasionally, and filled a number of local civil offices. A sect, of which he was the founder, though few in number,

existed for about a hundred years. He was also an author, and published *Simplicitie's Defense against Seven-Headed Policy; An Incorruptible Key composed of the CX. Psalm; An Antidote against the Common Plague of the World*, and other works.

GORTS'CHAKOFF, a Russian family, traces its ancestry through St. Michael of Tschernigoff (b. 1246) to Rurik and Vladimir the great.—PRINCE PETER Gortschakoff, governor of Smolensk, defended that town two years (1609–11) against Sigismund of Poland, when it was taken by storm.—PRINCE DIMITRI Gortschakoff, born 1756, was a celebrated Russian poet, and wrote odes, satires, and epistles. He died 1824.—PRINCE ALEXANDER Gortschakoff, born 1764, served under his uncle Suwaroff in Turkey and Poland, displayed great courage at the capture of Praga (a suburb of Warsaw), and was made lieut.gen. in 1798. In the campaign of 1799 he commanded under Korsakoff at Zürich, was subsequently made military governor of Viborg, repulsed marshal Lannes at Heilsburg, and commanded the right wing at the battle of Friedland. Appointed minister of war in 1812 he filled this post to the end of the war, when he was made gen. of infantry, and member of the imperial council. He died in 1825.—PRINCE ANDREAS Gortschakoff served in 1799 as maj.gen. under Suwaroff in Italy; and commanded a division of grenadiers at Borodino, in 1812, where he was wounded. In the campaign of 1813–14 he commanded the first corps of Russian infantry, and distinguished himself at Leipsic and Paris. He was made gen. of infantry in 1819, and in 1828 retired from active service.—PRINCE PETER Gortschakoff was born in 1790. Having made the campaigns of 1813 and 1814 he served in Caucasia under gen. Yermoloff. As chief of the general staff of Wittgenstein in 1826 he was one of the signers of the treaty of Adrianople. In 1839 he was appointed governor-general of eastern Siberia, and occupied that important post until, in 1851, he retired from active life. On the outbreak of the Crimean war, however, he offered his services, which were accepted; and at the battle of the Alma he commanded the left wing of the Russians. He also took part in the battle of Inkermann. He died in 1868.

GORTSCHAKOFF, PRINCE MIKAIL, brother of the preceding, was b. in 1795, commenced his military career as an officer of artillery, and distinguished himself in 1828 at the sieges of Silistria and Schumla. Chief of the staff of count Pahlen in 1831, he gave proofs of extraordinary valor in the battle of Ostrolenka and at the taking of Warsaw. He was wounded at Grohow, and made gen.; succeeded count Toll as chief of the staff of the whole army, was appointed gen. of artillery in 1843, and military governor of Warsaw in 1846. In 1853, he commanded the Russian forces in the Danubian provinces, crossed the Danube, at Braila, Mar. 23, 1854, occupied the frontiers of Bessarabia, and in Mar., 1855, directed the defenses of Sebastopol, attacked by the armies of Great Britain and France. As a reward for his services in this unsuccessful but still brilliant defense, prince Gortschakoff was appointed by the emperor Alexander II. lieut.gen. of the kingdom of Poland, and was for several years a wise and conciliatory representative of his youthful emperor at Warsaw. He died May 30, 1861.—PRINCE ALEXANDER M., Russian diplomatist, brother of the preceding, was born in 1798. He was secretary of the Russian embassy in London in 1824, was sent to Florence in 1830, to Vienna in 1832, and to Stuttgart in 1841. In 1854 he represented Russia in the Vienna conferences; and in 1856 he became minister of foreign affairs. In 1870 he issued his circular upsetting the treaty of 1856, and leading to the London conference of 1871. He was the guiding spirit of Russian policy during the critical period 1877–79, and was one of the most prominent members of the Berlin congress in 1878.

GORTYNA, an ancient city of importance on the southern side of the island of Crete. It stood on the banks of the small river Lethæus (Mitropolipotamo), at a short distance from the sea, with which it communicated by means of its two harbors, Metallum and Lebena. It possessed temples of Apollo, Pythius, Artemis, and Zeus. Near the town was the famous fountain of Sauros, inclosed by fruit-bearing poplars; and not far from this was another spring, overhung with an evergreen plane-tree which in popular belief marked the scene of the amours of Jupiter and Europa. Gortyna was the second city in Crete, next to Gnossus in importance. The two cities combined to subdue the rest of the island; but having gained their object, they quarreled with each other, and the history of both towns is from this time little more than a record of their feuds. Neither plays a conspicuous part in the history of Greece. Under the Romans Gortyna became the metropolis of the island. Some ruins may still be traced at the modern village of Hagii Deka.

GORUCKPÓRE, a city of Hindustan, in the lieut.-governorship of the n.w. provinces, and capital of a district of the same name, stands on the left bank of the Rapti, which joins, 85 m. further down, the Ghagra from the left, the whole of the intermediate course being navigable. It is in lat. 26° 42′ n., and long. 83° 23′ e., being 430 m. to the n.w. of Calcutta; and it contained '72, 51,117 inhabitants.—The district of Goruckpore has an area of 4,579 sq. m., and a population of 2,019,361.

GORY DEW, a dark red slimy film not unfrequently to be seen on damp walls and in shady places; often on the whitewashed walls of damp cellars, where its appearance is apt to occasion alarm from its resemblance to blood. It is one of the lowest forms of vegetable life, one of the *algæ* of the group *palmellaceæ* (included in *confervaceæ*), and

nearly allied to the plant to which the phenomenon of RED SNOW (q.v.) appears to be chiefly owing. Its botanical name is *palmella cruenta*. It sometimes extends over a considerable surface, and becomes a tough gelatinous mass. The structure and mode of growth of this and allied plants will be noticed under the head PALMELLACEÆ. Its characteristic red color appears also in *Hæmatococcus sanguineus*, a nearly allied plant, found in similar situations, but which seems to extend more as an aggregation of cells not soon melting down into an indefinite slime like the cells of the *palmella*. The prevalent color of the group, however, is green.

GÖRZ, or GÖRITZ, an important t. of Austria, in the crown-land of the Kustenland (coast districts), (q.v.), and capital of a district of the same name, is charmingly situated in a fruitful plain on the left bank of the Isonzo, about 25 m. n.n.w. from Trieste. Among its principal buildings are the old castle of the former counts of Görz, now used as a prison; and the cathedral, with a beautiful *sacrarium*. Görz has extensive sugar-refining, and manufactures of rosoglio, silks, linen, cotton, and leather; it has also a thriving trade in its manufactures and in dried fruits. Charles X. of France died here, Nov. 6, 1837. Pop. '69, 16,823.

GÖSCHEN, GEORGE JOACHIM, b. England 1831; educated at Rugby and Oxford, but declined to graduate having scruples about taking certain oaths. Going into mercantile business he paid special attention to financial questions, but left his firm in order to take office in the Russell-Gladstone ministry. He was returned in the liberal interest for the city of London in 1863, on the death of Mr. W. Wood, and he took an active share in throwing open the universities to dissenters, and in bringing about the abolition of religious tests. He was re-elected for the city of London, at the head of the poll, in July, 1865, and became vice-president of the board of trade, when he was sworn of the Privy Council, and chancellor of the duchy of Lancaster and a cabinet minister, 1866, retiring with the Russell ministry in June of that year. Upon Gladstone's accession to power, Dec., 1868, he was appointed president of the poor-law board, which office he held till March, 1871, when he succeeded Mr. Childers as the first lord of admiralty. He went out of office with his party, Feb., 1874. At the general election in that year he was the only liberal candidate returned for the city. In 1876 Göschen and M. Joubert were chosen as delegates of the British and French holders of the Egyptian bonds to concert measures for the conversion of the debts. Göschen attended the international monetary conference held at Paris, in Aug., 1878. He has written largely on financial questions, and his treatise on *The Theory of the Foreign Exchanges* has been translated into French. He has published his *Speech on the Oxford University Tests Abolition Bill*, and *Speech on Bankruptcy Legislation* and other commercial subjects.

GOS'HAWK, *Astur*, a genus of *falconidæ* (q.v.), distinguished from the true falcons by a lobe or festoon, instead of a sharp tooth, on the edge of the upper mandible, and by the shortness of the wing, which reaches only to the middle of the tail. It is more nearly allied to the sparrow-hawks, from which it is distinguished by its more robust form, by its shorter legs, and by the middle toe not being elongated, as in that genus. The species to which the name goshawk originally and strictly belongs (*A. palumbarius*), is very widely diffused over Europe, Asia, the north of Africa, and North America, chiefly inhabiting hilly and wooded regions. It is now very rare in Britain, particularly in England. Although one of those that were called *ignoble* birds of prey, it was much used for falconry, being easily trained, and very successful in catching such game as is either confined to the ground, or does not rise far from it, or such as is to be found in woods, through the branches of which the goshawk readily threads its way in pursuit. The goshawk was thus flown at hares, rabbits, pheasants, partridges, etc. It ordinarily seeks its prey by flying near the ground, and can remain a very long time on the wing. It follows its prey in a straight line, not rising in the air to descend upon it, like the falcons; and when baffled by the object of pursuit entering a wood and hiding itself in some covert, will perch on a bough, and await its reappearance with wonderful patience for many hours. Its flight is very rapid. The goshawk builds in trees. Its nest is very large. The female, which is much larger than the male, is about two feet in entire length. Both sexes are of a dark grayish-brown color, the upper surface of the tail-feathers barred with darker brown; there is a broad white streak above each eye; the under parts are also whitish, with brown bars and streaks.—Other species are found in India, south Africa, Australia, etc.

GO'SHEN, the name of that part of ancient Egypt which Pharoah made a present of to the kindred of Joseph when they came to sojourn in that country. It appears to have lain between the eastern delta of the Nile and the frontier of Palestine, and to have been suited mainly for a pastoral people, which the Hebrews were. Rameses, the principal city of the land, was the starting-point of the exodus of the chosen people, who reached the Red sea in three days. From this and other circumstances, it has been concluded that the *Wâde-t-Tumeylât* (the valley through which formerly passed the canal of the Red sea, and at the western extremity of which Rameses was situated) is probably the Goshen of the Old Testament.

GOSHEN, the seat of justice of Elkhart co., Ind., on the Lake Shore and Michigan and other railroads; and Elkhart river, 111 m. s.e. of Chicago; pop. 3,133. The village has a court-house, churches, banks, a high school, and manufactories of flour, iron, wool, furniture, and farming implements, all run by the water power of the river.

GOSHEN, the seat of justice of Orange co., N. Y., on the Erie and the Wallkill Valley railroads; pop. 2,205 exclusive of township. The chief occupations are the manufacture of bricks, tiles, cheese and butter—the latter article being famous for excellence. The village contains a court-house, six or seven churches and a number of classical schools.

GOS'LAR, a small but ancient and interesting t. of Hanover, is situated on the border of Brunswick, on the Gose, from which the town derives its name, 26 m. s.e. of Hildesheim. It was at one time a free imperial city, and the residence of the emperor. Of all the fortifications of which it once boasted, the walls and one tower—the Zwinger, the walls of which are 21 ft. thick—alone remain. Of the venerable cathedral, the porch (date 1150) is the sole relic; the remaining portion of the old imperial palace has been lately restored; the Gothic church in the market-place dates from 1521; the hotel called the *Kaiserworth* has eight portraits of German emperors. Goslar was founded by Heinrich I. about 920; and under Otto I. the mines, for which Goslar has ever since been celebrated were opened in 986. The mines of gold, silver, copper, lead, and zinc are, however, nearly exhausted. Pop. '75, 9,838.

GOSLICKI, WAWRZYNIEC, 1533–1607; a learned Pole, better known under his Latinized name of LAURENTIUS GRIMALIUS GOSLICIUS. Having studied at Cracow and Padua, he entered the church, and was successively appointed bishop of Kaminietz and of Posen. Goslicki, although an ecclesiastic, was an active man of business, was highly esteemed by his contemporaries, and was frequently engaged in political affairs. It was chiefly through his influence, and through the letter he addressed to the pope, that the Jesuits were prevented from establishing their schools at Cracow. He was also a strenuous advocate of religious toleration in Poland.

GOSNOLD, BARTHOLOMEW, d. Va., 1607; one of the earliest English voyagers, concerned in Raleigh's Virginia venture, and afterwards chosen by the earl of Southampton to found a colony in New England. He set out with a single small vessel and only 20 colonists in the spring of 1602, passing cape Cod (to which he gave its name), and landing at the mouth of Buzzard's bay, planted his colony on the island of Cuttyhunk. Many circumstances combined to render the enterprise unsuccessful, and three months later he conducted his people back to England, taking a cargo of furs, cedar, and sassafras root—the latter a valuable medicine. Gosnold then undertook a similar venture in Virginia, obtained a charter for a colony from James I. April 10, 1606, sailed with 3 vessels and 105 settlers, and laid the foundation of Jamestown, the first English settlement in the original United States. Gosnold fell a victim to the unhealthy climate, as did also 50 of the colonists.

GOSPELERS, a name applied to different classes of persons with three different meanings. I. As a term of reproach by Romanists to those who strove to circulate the Scriptures in the language of the people. It was first applied in England to Wickliffe and his followers when he had translated the New Testament into English. II. At the time of the reformation to a class of antinomians concerning whom bishop Burnet says: "I do not find anything objected to them as to their belief save only that the doctrine of predestination having been generally taught by the reformers, many of this sect began to make strange inferences from it, reckoning that since everything is decreed, and the decrees of God could not be frustrated, therefore men were to leave themselves to be carried by these decrees. This drew some into great impiety of life, and others into desperation. The Germans soon saw the ill effects of this doctrine. Luther changed his mind about it, and Melancthon wrote against it. Calvin and Bucer were for maintaining the doctrine of these decrees; only they warned the people not to think much concerning them, since they were secrets which men could not penetrate into. Hooper, and many other good writers, did often exhort the people against entering into these curiosities· and a caveat to the same purpose was afterwards put into the article of the church about predestination." III. In the ritual of the church of England the minister who read the gospel for the day, standing at the n. side of the altar, was formerly called the *gospeler*, in distinction from the reader of the epistle—standing at the opposite side—who was called the *epistoler*.

GOSPELS. The expression is derived from the Anglo-Saxon, and means literally *good news*. The message of Christ, or the doctrine of Christianity, was called the gospel (*to euaggelion*); and the inspired records by which this message or doctrine have been transmitted to the church in successive ages, have received the name of the gospels (*ta euaggelia*). When this name was first distinctly applied to these records, is uncertain. The use of it in Justin Martyr, about the middle of the 2d c., is a subject of dispute. It appears to have been in common use in the course of the 3d century.

I. *Genuineness*.—The primary and most interesting inquiry concerning the gospels is as to their genuineness. They profess to be the inspired records of our Lord's life—of his sayings and doings—proceeding in two cases from men who were his apostles and

companions (Matthew and John); and in the two other cases from men who, although not themselves apostles, were apostolic in their position and character, the immediate companions and fellow-laborers of the apostles (Mark and Luke). According to their profession, they were all composed during the latter half of the 1st c.; the three *synoptic* gospels, as they are called, probably during the decade preceding the destruction of Jerusalem by Titus (60–70), and the fourth gospel of St. John near the close of the century. The question as to their genuineness is in the main the question as to the fact of their existence at this early period; the special authorship of each gospel is a comparatively less important question.

It is obvious that the existence of the gospels within the 1st c. is a point which can only be settled by the ordinary rules of historical evidence. What traces have we of their existence at this early period? As Paley illustrates the matter, we can tell of the existence of lord Clarendon's *History of the Rebellion* at a period antecedent to bishop Burnet's *History of his Own Times*, by the fact that Burnet quotes Clarendon. If the gospels existed in the 1st c., therefore, we shall expect to find similar evidences of their existence in the Christian writings of the 2d and 3d centuries. We do find such evidence in abundance during the 3d century. In such writers as Origen and Cyprian, we not only find quotations from the gospels, but we find the gospels themselves mentioned by name as books of authority amongst Christians. From the writings of Origen alone, if they had survived, we might have collected, it has been said, the whole text not only of the gospels, but the Old and New Testaments. At this point, then, there is no question. No one can dispute the existence of the gospels in the age of Origen, or that immediately preceding—that is to say, in the beginning of the 3d century. But we can ascend with an almost equally clear light of evidence to the time of Irenæus, or the last quarter of the 2d century. The passage in which Irenæus speaks of the gospels is so significant and important that it deserves to be extracted. "We," he says (*Contra Hæres.* lib. iii. c. 1), "have not received the knowledge of the way of our salvation by any others than those through whom the gospel has come down to us; which gospel they first preached, and afterwards, by the will of God, transmitted to us in writing, that it might be the foundation and pillar of our faith." "For after our Lord had risen from the dead, and they (the apostles) were clothed with the power of the Holy Spirit descending upon them from on high, were filled with all gifts, and possessed perfect knowledge, they went forth to the ends of the earth, spreading the glad tidings of those blessings which God has conferred upon us. *Matthew among the Hebrews published a gospel in their own language;* while Peter and Paul were preaching the gospel at Rome and founding a church there. And after their departure (death), Mark the *disciple and interpreter of Peter himself delivered in writing what Peter had preached; and Luke, the companion of Paul, recorded the gospel preached by him. Afterwards, John, the disciple of the Lord, who leaned upon his breast, likewise published a gospel while he dwelt at Ephesus in Asia.*" These words are very explicit and to the point; and elsewhere, Irenæus speaks still more particularly of the several gospels, and endeavors to characterize them in a somewhat fanciful way, which, if it does not prove his own judgment, at least proves the kind of veneration with which the gospels were regarded in his time. It is equally beyond question, then, that the gospels were in existence in the end of the 2d c., and that they were attributed to the authors whose names they bear. "It is allowed by those who have reduced the genuine apostolic works to the narrowest limits, that, from the time of Irenæus, the New Testament was composed essentially of the same books as we receive at present; and that they were regarded with the same reverence as is now shown to them."—Westcott, *History of Canon.* The evidence upon which we accept as undoubtedly genuine the productions of many classic authors, is not to be compared in clearness and fullness to the evidence for the genuineness of the gospels at this stage. Any difficulties that the subject involves begin at a point higher up than this.

The age of Irenæus is the *fifth* generation from the beginning of the apostolic era—the *third* from the termination of it. The ascending generations may be characterized as those (4) of Justin Martyr, and (3) of Ignatius and Papias; and (2) of St. John, or the later apostolic age. It is within these three generations, and especially within the third and fourth, that the subject of the genuineness of the gospels gives any cause for hesitation and discussion.

Such writers as Justin Martyr and Ignatius nowhere quote the gospels by name. In a fragment of Papias preserved by Eusebius, there is mention of Matthew and Mark having written accounts of the actions and discourses of our Lord; but with this exception, there is no mention of the gospels, or of their authors by name, in these earlier Christian writers. Not only so, but Justin Martyr appeals constantly to sources of information which he styles not "gospels" of St. Matthew, St. Luke, or St. John, but *Memoirs of the Apostles* (*apomnēmoneumata tōn apostolōn*). The phrase *a kaleitai euaggelia* (which are called gospels), which follows the former in the common version of Justin's text, is supposed by many to be an interpolation. This has given rise to a good deal of discussion as to the effect of Justin Martyr's evidence on this subject. The discussion has been of this nature. Were these *Memoirs of the Apostles* our gospels, or were they some other books of information as to Christ's sayings and doings to which he had access? Many German critics have been confident that they were not our gospels; and bishop Marsh has gone the length of saying that Justin did not quote our gospels. The

question, therefore, as to whether Justin Martyr quotes our gospels, may be said to be the turning-point in the evidence for their genuineness. Although not altogether free from difficulty, it appears to us that no reasonable doubt can be entertained that the *Memoirs of the Apostles* to which Justin constantly refers were no other than our gospels. This appears conclusively established by the three following considerations: (1) The degree of coincidence which exists between the numerous passages which Justin quotes from his *Memoirs*, and the corresponding passages in the gospels.—The *verbal* coincidence with the text of the gospels is sometimes exact, and sometimes so nearly so as to appear exact in a translation. The want of entire verbal coincidence is just what might be expected in a writer like Justin, who quotes the Old Testament in the same general manner, and is the very same as we find in other writers both before and after him. Further, the account which he gives of the origin of the *Memoirs* corresponds with the origin of the gospels—viz., that two were written by apostles, and two by companions of the apostles. (2) The extreme improbability that there could have been other books besides the gospels of the same apparently authoritative character, all trace of which have disappeared, and of which, in fact, we find no indication save in Justin Martyr.—Everything seems against such a supposition. The books of which Justin speaks were read in the assemblies of the Christians on Sundays: they were regarded with respect and veneration; they were evidently looked upon as authoritative. It is wholly inconceivable, that if there were such books other than the gospels, they should not have been mentioned by other writers as well as Justin; or that they should have utterly perished. (3) The certainty, from the statements of such writers as Irenæus in the generation immediately following him, that Justin must have known our gospels.—In this later generation we find the gospels everywhere diffused: received and reverenced alike at Alexandria, Lyons, and Carthage; by Clemens Alexandrinus, Irenæus, and Tertullian. They could not all at once have attained this wide diffusion, or started into this position of authority. The manner in which Irenæus speaks of them can only be accounted for by the fact that he had received them from his teachers; that they had been handed down to him as inspired authorities from the first ages. We must take the light of such a statement with us in ascending to the age of Justin Martyr; and in this light it is unintelligible that the gospels should not have been known to Justin, and consulted by him. The mere fact of his calling his authorities by the peculiar name of *Memoirs* cannot be set against all this evidence. The name of *Memoirs*, indeed, rather than gospels, was only a natural one for this writer to use, with his classical predilections and philosophical training, and considering that he was addressing a heathen emperor, and through him the gentile world at large.

When we ascend beyond the age of Justin to Ignatius and Papias, we find in a fragment of the latter, as has been already stated, mention of Matthew and Mark having written accounts of the life of the Lord; while in the letters of the former, as in the still earlier epistle of Clemens Romanus and the so-called epistle of Barnabas—both of which belong to the 1st c., and consequently reach the apostolic age itself—we find various quotations that seem to be made from the gospels. The quotations from St. Matthew are the most numerous. If these quotations stood by themselves, it might be doubtful how far they constituted evidence of the existence of the gospels at this early period. They might possibly indicate merely a uniformity of oral tradition as to the sayings of our Lord; but when we regard them in connection with the position of the writers, and the whole train of thought and association in which they occur, they seem to bear out the widest conclusion we could wish to found on them. The existence and character of such men as Ignatius and Clemens are unintelligible save in the light of the gospel history.

In addition to this chain of direct Catholic evidence for the genuineness of the gospels, the fragments which have been preserved of heretical writers furnish important, and in some respects singularly conclusive evidence. The Gnostic Basilides quotes the gospels of St. John and St. Luke about the year 120. The heretics appealed to them as well as the Catholic writers, and in this fact there is a strong guarantee that no fictions or inventions could have been palmed off upon the church in the 2d c., as the most renowned German theory as to the origin of the gospels virtually supposes. Upon a review of all the evidence from the apostolic fathers down to the council of Laodicea, when the four gospels are reckoned as part of the canon of Scripture, "there can hardly be room for any candid person to doubt," it has been said, "that from the beginning the four gospels were recognized as genuine and inspired—that a line of distinction was drawn between them and the so-called apocryphal gospels." As a mere question of literary history, the genuineness of the gospels certainly rests on far higher evidence than that on which we receive, without hesitation, many ancient writings.

II. *Internal Character and Contrast.*—After the genuineness of the gospels, the next point of importance regarding them is the relation which they bear to one another in respect of their contents and arrangement—the coincidences and discrepancies with one another which they present. The most obvious distinction among the gospels as a whole is between the gospel of St. John and the three synoptical gospels, as they are called. Matthew, Mark, and Luke, in narrating the ministry, discourses, and miracles of our Lord, confine themselves exclusively to what took place in Galilee until the last journey to Jerusalem. We should not know from them of the successive journeys that

our Lord made to Jerusalem. John, on the contrary, brings into view prominently his relation to Judea; and of the discourses delivered in Galilee, he only records one, that, namely, in the 6th chapter. It is obvious, on a superficial glance, that John had a special object in writing his gospel, an object in some respects more *dogmatical* than historical; and it is probable that, having seen the preceding gospels, he purposely abstained from writing what they had already recorded, and sought to supply such deficiencies as appeared to exist in their records. When we have no knowledge of the subject, this at least seems as probable a supposition as any other. A comparison of the three synoptical gospels reveals some interesting results. If we suppose them respectively divided into 100 sections, we shall find that they coincide in about 53 of them; that Matthew and Luke further coincide in 21; Matthew and Mark in 20; and Mark and Luke in 6. This, of course, applies to the substantial coincidence of fact and narrative in each case. The relative verbal coincidence is by no means so marked; it is, however, very considerable, and presents some interesting features, which prof. Andrew Norton has set forth clearly in his admirable work on the *Genuineness of the Gospels*.

It is not desirable to go into further details in this place; but the result of the extremely critical and minute scrutiny to which the text of the gospel has been subjected may be stated as follows. There is a singular coincidence in substance in the three synoptic gospels. "Substantial unity with circumstantial variety," is a saying strictly true of them—more true of them than of any authors professing to narrate the same circumstances. The coincidence is greatly more apparent in the discourses than in the narrative parts of the gospels, most of all apparent in the spoken words of our Lord. At the same time, there are certain portions of narrative of great importance, that show in the several evangelists almost a verbal coincidence, as in the call of the first four disciples and the accounts of the transfiguration. "The agreement in the narrative portions of the gospels begins with the baptism of John, and reaches its highest point in the account of the passion of our Lord, and the facts that preceded it; so that a direct ratio might be laid between the amount of agreement and the nearness of the facts related to the passion. After this event, in the account of his burial and resurrection, the coincidences are few." There are no parts that furnish more difficulty, in the way of formal harmony, than the narrative of the resurrection.

The language of all the gospels is well known to be Greek with Hebrew idioms, or what has been called Hellenistic Greek. The tradition, however, of a Hebrew original of St. Matthew's gospel is uniform. In the fragment of Papias, and in the statement of Irenæus—the earliest sources in which we have any distinct mention of the gospels—it is plainly asserted that Matthew wrote his gospel in the Hebrew dialect. The fact is made a mark of distinction between his gospel and the others. The same uniformity of tradition ascribes the gospel of St. Mark to the teaching of St. Peter. The gospel of St. Mark is the most summary of the three, yet, in some respects, it is stamped with a special individuality and originality. It describes scenes and acts of our Lord and others with a minutely graphic detail, throwing in particulars omitted by others, and revealing throughout the observant eye-witness and independent historian.

III. *Origin of the Gospels.*—This is a separate inquiry from their genuineness, although intimately connected with it, and springs immediately out of those facts as to the internal agreement and disagreement of the gospels of which we have been speaking. The inquiry has been treated in an extremely technical manner by many critics, and it would not suit our purpose to enumerate and examine the various theories which have been propounded on the subject. We may only state generally, that the object of these theories has been to find a common original for the gospels. Some profess to find such an original in one of the three gospels, from which the others have been more or less copied, and each of them in turn has been taken as the basis of the other two. The more elaborate theories of Eichhorn and bishop Marsh, however, presume an original document, differing from any of the existing gospels, and which is supposed to pass through various modifications, into the threefold form which it now bears in them. It appeared to Eichhorn that the portions which are common to all the three gospels were contained in a certain common document from which they all drew. It had been already assumed that copies of such a document had got into circulation, and had been altered and annotated by different hands. But Eichhorn works out an elaborate hypothesis on such a presumption. He requires for his purpose no fewer than five supposititious documents. The conditions of the problem cannot be met otherwise. These are in order. 1. An original document; 2. An altered copy which St. Matthew used; 3. An altered copy which St. Luke used; 4. A third copy made from the two preceding, used by St. Mark; 5. A fourth altered copy used by St. Matthew and St. Luke in common. Bishop Marsh, in following out the same process of construction, finds it necessary to increase the supposititious documents to eight, which we need not describe. There is not the slightest external evidence of the existence of such documents, and theories of this kind, which, in order to explain difficulties, call into existence at every stage an imaginary solution, do not require serious refutation.

Another and more probable supposition is, that the gospels sprang out of a common oral tradition. The preaching of the apostles was necessarily, to a great extent, a preaching of facts; and so zealously did they give themselves to the task of promul-

gating the wondrous life and death of Christ, that they early divested themselves of the labor of ministering to any of the lower wants of the congregations of disciples that they gradually gathered round them. It is obvious that, in the course of their active "ministry of the word," the facts of our Lord's life and death, of which they had been eye-witnesses, would gradually assume a regular outline. What the reading of the gospels is to us, the preaching of the apostles would be very much to the early Christians. The sermon of Peter at Cæsarea (Acts x. 34) may give some imperfect idea of the character of this preaching. The facts thus briefly indicated would expand in frequent communication to something of the more detached and living form which they exhibit in the gospels, or rather in what we may suppose to have been the common substratum or groundwork of the gospels. It is to be remembered that the apostles were promised that the Holy Spirit would "bring all things to their remembrance, whatsoever the Lord had said unto them" And this constant guidance and superintendence of the Divine Spirit would sufficiently account for the uniformity and consistency of their oral instruction, even although not reduced to writing for a considerable number of years. Allowing for the widest space of years it may be necessary to assume before the writing of the first gospel, the chief apostles themselves are yet living at the end of this space. It is not a mere tradition of their teaching that survives, but it is their own living witness that is circulated from church to church, as they pass to and fro in their evangelistic labors.

It is impossible to say whether this hypothesis of the origin of the gospels be really the correct one or not; all we need to say is, that it seems to possess more probability in itself than any hypothesis of a common written source, from which they were respectively borrowed, and which has disappeared. It fits, moreover, into the facts of the case.—Westcott, *Introduction to the Study of the Gospels*, p. 189.

According to this view of the origin of the gospels, that of St. Mark, if not the oldest in composition, is yet probably the most direct and primitive in form. In its lifelike simplicity and comparative unconsciousness of aim, it represents most immediately the apostolic preaching; it is the testimony delivered by St. Peter, possibly with little adaptation. Historical evidence, as we have already said, is uniform as to the association of Mark and Peter: Mark is everywhere *interpres Petri*. The gospels of St. Matthew and St. Luke, again, "represent the two great types of recension to which it may be supposed that the simple narrative was subjected. St. Luke represents the Hellenic, and St. Matthew the later Hebraic form of the tradition, and in its present shape the latter seems to give the last authentic record of the primitive gospel."

A common oral gospel seems also to present the most natural explanation of the accordances and variations of the three synoptic gospels. The words of the Lord, which present in all such a marked uniformity, would necessarily assume a more fixed character in such an oral tradition, while the narrative surrounding them would remain comparatively free. Single phrases of a peculiar and important character would be closely retained; there would be, exactly as we find, a uniform strain of hallowed language mingling with variations in detail—a unity of tone, and even of speech, with variety of modulation and emphasis.

The development of the famous Tübingen theory of the origin of the gospels, by F. C. Baur (q.v.), marked an important epoch in critical study. He sought the cause of the differences between the several gospels, not in vague myths or the fantasy of individuals, but in the dominant spiritual tendencies of the apostolic age. He gave greater scope to the influence of such tendencies by adopting the view that the latest of the gospels, John's, was not written till about 170 A.D. The most characteristic thought of Baur's criticism was that the gospel of John is not a historical record, but a designedly dogmatical work, in which the historical element is but the transparent envelope of the theological truths, and is used as the artistic setting for a body of profound religious thought. The three synoptic gospels, of which Baur assumed Matthew's to be the earliest, are much freer from dogmatic presupposition, though in Matthew a Judaical, and in Luke a Pauline influence is traceable.

Since Baur's time, all critics are either his supporters or his opponents. The literature is most voluminous. The chief recent names are Bleek, Weisse, Ewald (against Baur). Weizsäcker, Hilgenfeld, Holtzmann, and Keim. The orthodox view is well represented by Westcott's *Introduction to the Study of the Gospels*, and Tischendorf's *Wann wurden unsere Evangelien verfasst?* (Eng. trans. 1867).

GOSPEL SIDE OF THE ALTAR, the right side of the altar or communion table, looking from it, at which, in the English church service, the gospel appointed for the day is read. It is of higher distinction than the epistle side, and is occupied by the clergyman of highest ecclesiastical rank who happens to be present. In some cathedrals, one of the clergy has this special duty to perform, and is designated the gospeler.

GOSPORT ("God's port"), a market-town and seaport of England, in the co. of Hants, stands on the western shore of Portsmouth harbor, and directly opposite Portsmouth, with which it is connected by a floating bridge. It is 14 m. s.e. of Southampton, and 89 m. s.w. of London by the London and South-Western railway. It is inclosed within ramparts, which seem a portion of those which also surround Portsmouth and Portsea. The Haslar gunboat shipyard, connected with the town, is used for hauling up

and keeping in repair all the gunboats belonging to this port. An extensive iron foundry for the manufacture of anchors and chain-cables, and considerable coasting-trade are here carried on. The main feature of Gosport, however, is the *royal Clarence victualing yard*, which contains a brewery, a biscuit-baking establishment worked entirely by steam, and numerous storehouses. The bakery can turn out ten tons of biscuit in one hour. In the immediate vicinity is Haslar hospital, erected in 1762, the chief establishment in Great Britain for invalid sailors, of whom 2000 can be accommodated and supplied with medical attendance. Pop. '71, 7,366.

GOS'SAMER, a light filamentous substance, which often fills the atmosphere to a remarkable degree during fine weather in the latter part of autumn, or is spread over the whole face of the ground, stretching from leaf to leaf, and from plant to plant, loaded with entangled dew-drops, which glisten and sparkle in the sunshine. Various opinions were formerly entertained concerning the nature and origin of gossamer, but it is now sufficiently ascertained to be produced by small spiders, not, however, by any single species, but by several, not improbably many, species; whilst it is also said to be produced by young, and not by mature spiders, a circumstance which, if placed beyond doubt, would help to account for its appearance at a particular season of the year. The production of gossamer by spiders was first demonstrated by the observations of Dr. Hulse and Dr. Lister in the 17th c., but these observations did not for a long time meet with due regard and credit, particularly amongst the naturalists of continental Europe. It is not yet well known if the gossamer spread over the surface of the earth is produced by the same species of spider which produce that seen floating in the air, or falling as if from the clouds. Why gossamer threads or webs are produced by the spiders at all, is also a question not very easily answered. That they are meant merely for entangling insect prey, does not seem probable; the extreme eagerness which some of the small spiders known to produce them show for water to drink, has led to the supposition, that the dew-drops which collect on them may be one of the objects of the formation of those on the surface of the ground, whilst it has been also supposed that they may afford a more rapid and convenient mode of transit from place to place than the employment of the legs of the animal. As to the gossamers in the air, conjecture is still more at a loss. They are certainly not accidentally wafted up from the ground, as might be supposed; the spiders which produce them are wafted up along with them; but whether for the mere enjoyment of an aërial excursion, or in order to shift from place to place, is not clear, although the latter supposition is, on the whole, the most probable. The threads of gossamer are so delicate that a single one cannot be seen unless the sun shines on it; but being driven about by the wind, they are often beaten together into thicker threads and flakes. They are often to be felt on the face when they are scarcely visible. The spiders which produce these threads shoot them out from their spinnerets, a viscid fluid being ejected with great force, which presently becomes a thread; sometimes several such threads are produced at once in a radiating form, and these being caught by the ascending current of heated air, are borne up, and the spider along with them. It has been said that the spider has even some power of guiding in the air the web by which it is wafted up.

GOSSE, Philip Henry, b. England, 1810; early exhibited intense fondness for natural history, but embarked in mercantile business in Newfoundland. He visited Lower Canada, studying zoology, and entomology, for three years. He traveled through the United States, and resided in Alabama for a year, making a collection of drawings of insects, especially the fine lepidoptera of that region. In 1839, returning to England, he published *The Canadian Naturalist*, 1840. In 1844 he visited Jamaica, and spent eighteen months in the collection and study of the zoology of that island; publishing the result in *The Birds of Jamaica*, followed by an atlas of *Illustrations*, and *A Naturalist's Sojourn in Jamaica*. The composition of numerous works on zoology and other subjects chiefly for the society for promoting Christian knowledge, occupied several years, during which time he also turned his attention to the microscope, by the aid of which he conducted his latest researches. His special delight was the study of British rotifera, and he made a valuable collection of facts concerning them, with a view to publication. In *A Naturalist's Rambles on the Devonshire Coast* he describes his investigations. In 1854 he published *The Aquarium, A Manual of Marine Zoology*, and *Tenby, a Seaside Holiday;* and in 1857, *Omphalos; an attempt to untie the Geological Knot.* In the autumn of the same year he removed from London to Torquay, and published the most important of his works, *Actinologia Britannica; a History of the British Sea Anemones and Corals.* He has written *Evenings at the Microscope; Letters From Alabama; The Romance of Natural History; A Year at the Shore, and Land, and Sea.* In 1856 he was elected a fellow of the royal society.

GOSSELIES, a t. of Belgium, in the province of Hainaut, four m. n. by w. from Charleroi, and on the canal from Charleroi to Brussels. It has manufactures of woolen cloth, hats, nails, cutlery, soap, etc.; also bleach-fields and tanneries. There are coal-mines in the vicinity. Pop. '70, about 7,000.

GOSSYPIUM. See Cotton.

GOTA, a river in s. Sweden, connecting Wener lake with the Cattegat. Canals and locks make navigation from the Baltic to lakes Wener and Wetter easy and profitable. This river is noted for the romantic scenery along its banks.

GO'TAMA, a native of India, the date of whose birth and death are unknown, but supposed to have lived in very ancient times. He is the author, according to some critics, of the *Nyaya Sutra;* and sir William Jones held that from his writings on logic Aristotle took the syllogism. The drift of critical opinion, however, is that Gotama was indebted to Greece.

GO'THA, a t. in Germany, capital of the duchy of Saxe-Coburg Gotha, is situated on an elevation in a beautiful district on the right bank of the Leine, 18 m. w. of Erfurt, by the Thuringian railway. It is a handsome, well-built town, is quadrilateral in form, and was formerly surrounded by walls, which, however, have been thrown down, and public walks laid out in their place. The principal public building is the large ducal palace of Friedenstein, with two large side-wings, and two towers of 144 ft. in height. This palace contains a picture-gallery, in which Cranach, V. Eyck, Holbein, Rubens, and Rembrandt are represented; a cabinet of engravings (a very valuable collection); a library (founded by Ernst the Pious in 1640) of 170,000 volumes and 6,000 manuscripts (2,000 Arabic); a cabinet of Egyptian, Roman, Greek, and German antiquities; a collection of about 80,000 coins, and 13,000 medals, one of the finest collections in Europe; and a Japanese and Chinese museum. Gotha has also an arsenal, a new and old town-hall, and numerous educational and benevolent institutions. The principal manufactures are porcelain, colored paper, cloth, tobacco, sugar, toys, machinery, musical and surgical instruments, etc. Gotha sausages have a widespread celebrity. Several hundreds of designers, engravers, printers, and colorers of maps are employed here in Justus Perthes's large geographical establishment. Pop. '75, 22,928.

GOTHA, ALMANACH DE, a universal political register, is published annually at Gotha (q.v.). The publication of this almanac commenced in 1764, in the German language, in which it was continued until Napoleon I. became emperor, when it was changed to the French language; it has recently been published in both tongues. The almanac is a small pocket volume containing at present nearly one thousand pages of small type, and recording the sovereigns and royal families of every civilized country, with the civil, diplomatic, military, and naval officers, a great amount of statistical information, a compact summary of historical events, obituary notices of the most distinguished persons, and other matters of political interest. No book ever printed contains so much political and statistical information in so small a compass. The boundaries of states are given according to the latest treaties, with their extent, population, and revenues. The *annuaire diplomatique* contains the name of every diplomatic representative and *attaché* of Europe and America. The pay of officers of governments, national expenditures and debts, with the interest, the number of representatives, under representative governments, and their proportion to the population, are carefully given. As a work of such an extent cannot be brought down to the end of the year, the date of publication is stated, and in some instances a date has been given to each page, as completed, to show that the editor is not answerable for subsequent changes. When the *Almanach de Gotha* was commenced, there was but one republic in existence—that of Switzerland. It was then little more than a register of the crowned heads and royal families of Europe. It has been slow to recognize political changes, and for years after the French revolution, continued to print under the head of "France," Louis XVII. as the reigning monarch. It was not until Napoleon became emperor that his name found a place in its pages, and then his whole family was given, as with the other royal houses. During the empire, Napoleon I. considered this little publication so important, that he exercised over it a rigid supervision, and in 1808 an entire edition, which had just been worked off, was seized because Anhalt took precedence of Napoleon. To secure this re-arrangement of the alphabet, the edition of that year was printed at Paris. It is probable that a similar supervision of the press kept out of the historic pages the successes of the allies against the empire in the succeeding numbers, in which there was no mention of the campaigns of the peninsula and the victory of Trafalgar. On the restoration of the Bourbons, however, these events were recorded in a *resumé*.

GOTHA, DUCHY OF.* See SAXE-COBURG-GOTHA.

GOTHAM, a parish in England, in Nottinghamshire, the name of which is used as a synonym for simple or foolish people. This usage arose from the tradition that when king John proposed making a progress through the town with the intention of purchasing a castle the people being averse to the expense of maintaining royalty, determined to disenchant him by engaging in the most idiotic pursuits. The king turned away, and the wise men of the town remarked "that more fools pass through Gotham than remain in it." Irving, in his *Knickerbocker History*, applies the epithet to New York in the time of the Dutch.

GOTHARD, ST. a mountain group in the Helvetian Alps, reaches in its highest peaks the height of 12,000 ft. See ALPS. St. Gothard, however, is chiefly famous for the pass

over the Alps, which at its summit rises to the height of 6,800 ft. By means of this pass, the high road from Fluelen, on lake Lucerne, is carried without interruption in a s.s.e. direction to Lago Maggiore, in the north of Italy. The road over the pass, made between 1820 and 1832, was destroyed throughout a great part of its length by violent storms in 1834 and 1839. Since that time, however, it has been in a good state of repair. It is one of the best and most convenient of the Alpine carriage-ways, is free from snow for four or five months of the year, and is remarkable for the grandeur of its scenery. In 1870 Germany, Italy, and Switzerland signed an agreement for the construction of a railway with a tunnel through the St. Gothard. The chief difficulty in the way of apportioning the expense was removed in 1879, when the Swiss confederation agreed to bear part of the burden along with the several Swiss cantons through which the line passes, and the two Swiss railways. The total cost is estimated at something over £9,000,000. At the beginning of 1879 more than 7¼ m. (the total length of the Cenis tunnel) had already been bored, leaving less than 3,000 yards to accomplish. The tunnel is to be opened for traffic in 1880.

GOTHENBORG, a province of Sweden forming a narrow territory along the Cattegat and the Skager Rack; 1,890 sq. m.; pop. '78, 252,952. It is rough and mostly sterile, with a severe climate. The chief town bears the same name.

GOTHENBURG. See GOTTENBORG.

GOTHIC ARCHITECTURE. Under this title are comprised the various styles of architecture which prevailed in western Europe from the middle of the 12th c. to the revival of classic architecture in the 16th century. The term *Gothic* was at first bestowed by the Renaissance architects on the mediæval styles as a term of reproach. This epithet they applied to every kind of mediæval art which had existed from the decline of the classic styles till their revival, all other styles being by them considered as *barbarous* and *Gothic*. The name has now, however, become generally adopted, and has outlived the reproach at first implied in it. It has also become limited and defined in its application. During the present century, the arts of the middle ages have been attentively studied, and their origin and history carefully traced; and as the knowledge of these styles has increased, a feeling of admiration has succeeded to that of contempt, and Gothic now ranks as one of the noblest and completest styles of architecture ever invented.

Origin.—The origin of Gothic architecture has given rise to many very ingenious speculations. It has been said that the style was copied directly from nature; that the pointed arches and groins of the vaults were imitated from the overarching branches of trees; and that the stems of an avenue were the originals of the pillars of the Gothic aisles. Others have strenuously maintained that the invention of the pointed arch was a mere accident, arising from this form having been observed in the interlacing of the circular arches of a Norman arcade. It has also been stated that the style was imported from the East during the Crusades, and that the mediæval architects had but little to do with its origin.

More careful study of the Gothic buildings which remain to us, has dispelled these fanciful ideas, and settled the origin and progress of the art on historical as well as internal evidence.

To trace Gothic up to its primary elements, we should have to go far back in the world's history. Some maintain that there are only two styles of architecture of which we have any knowledge—viz., Greek architecture and Gothic architecture; that these are the two typical styles, and that in them are contained all the elements of which all other styles are composed.

This is no doubt to some extent true, just as it is also true that all things in nature are derived from a few primary elements. But as there are many varieties in nature, so there are many developments of the two typical forms of architecture, all of which deserve to be classed as styles.

Greek architecture is the type of the trabeated style—i. e., the style whose principal feature is the straight lintel; Gothic is the type of arcuated architecture, in which the voids are spanned by arches. Of these typical forms there are many varieties. Roman architecture (q. v.) is the transition form between them. The Romans adopted the Greek form of decoration and the Gothic form of construction; they decorated their exteriors with columns crowned by straight architraves and cornices, and inside these they formed the real construction with arches and vaults. The use of the latter gradually extended, especially in the construction of interiors, and by means of vaults the Romans were able to roof in large areas without encumbering the floor with pillars. This was found to be a very advantageous system of construction, and was carried out in many important examples, as, for instance, in the baths of Caracalla and Diocletian (see BATHS), the basilica of Constantine, etc. In their works of public utility, where use, not decoration, was the chief object, the Romans always adopted the arch as the fittest mode of construction—as in their aqueducts (q. v.), bridges, etc. The arch thus came gradually more and more into use; and about the time when the barbarians first overran the provinces, the arcuated form of construction was universal, and some attempts had been made to conform the Greek decoration to the circular arches by

bending the entablature round the curve—as in the palace of Diocletian at Spalato, in Dalmatia.

To the Romans, therefore, is due the introduction of an arcuated construction with a well developed internal, and a partially developed external decoration. The early Christians adopted their forms of construction and decoration from the Romans. They were also indebted to them for the plans of the buildings, which became the types of the Christian sacred edifices during the middle ages. The Basilica (q. v.), or Roman court-house and market-place, was found to be admirably adapted for early Christian worship, and the circular temples were the prototypes of the Christian baptisteries (q. v.) which usually accompanied the basilicas. In erecting their buildings, the Christians not only adopted the plans and mode of construction, but used the actual materials of the buildings of the Romans, many of which had been destroyed by the barbarians. Where such materials were abundant—as in Rome and central Italy—the early Christian architecture very closely resembled that of the Roman buildings which had preceded it. But in more remote districts the builders, finding no ready-made materials at hand, had to design and prepare new ones. In doing so they followed as closely as they could the Roman originals, but their buildings partook more of the constructional than the decorative elements of Roman architecture. The Roman ornament thus dropped out of use; and when, in process of time decoration was desired, each new people followed its own ideas. The traditional Roman decoration thus became to a great extent lost, and new styles introduced. These new styles each retained some of the original Roman forms and modes of construction; and each style depended for its peculiar character on the particular Roman forms it retained and developed. Thus Constantine, and the architects of the East, seized upon the *dome* as the distinguishing feature of their style, and the architects of Lombardy adopted the plain tunnel-vault. The former style is called Byzantine (q. v.), and has been the type of all eastern mediæval architecture; and the latter Romanesque (q. v.), and has been the origin of all the western architecture of mediæval Europe.

History.—From Lombardy—in those ages part of the German empire—the Romanesque style readily passed into Germany and Switzerland, and was also most naturally adopted in the s. of France, where examples of Roman architecture abounded. This architecture was carried out with various modifications in these different countries, all of which may have contributed to the general progress of the art; but, as might be expected, it is to the banks of the Rhine where the successors of Charlemagne chiefly dwelt, that we must look for the first step in the development of Gothic architecture. The following short sketch of the development of vaulting will show how this occurred.

The Roman basilicas, and, like them, the early Christian churches, were divided into a central nave with two side-aisles, the former separated from the latter by a row of columns on each side. These columns carried arches on which rested the side walls of the nave, which were carried sufficiently high to clear the roofs of the side-aisles, and admit windows to light the central nave. This row of windows afterwards became the Gothic clerestory (q.v.). The apse at the end of the nave was semicircular on plan, and was usually roofed with a vault in the form of a semi-dome. This feature was also afterwards more fully developed in the chapels of Gothic churches. The nave and side-aisles were originally roofed with wood, but, owing to their frequent destruction by fire, it became necessary to cover the churches with a more enduring kind of construction. Vaulting was then introduced, the Roman forms, of which many examples existed, being at first closely followed. To trace the progress of vaulting from the simple tunnel-vault of the Romans to the fully developed and magnificent groins of Gothic cathedrals, is a most interesting inquiry; and, indeed, includes the history of the development of Gothic architecture. There is one consideration which will help to explain how the Roman arches were abandoned and new forms sought out. To the Roman emperors who built the splendid vaults of the baths, and who had a subdued world at command, *materials* and *labor* were a small consideration. They could, therefore, afford to build in a style which required perfect materials and workmanship. But mediæval princes and bishops could obtain neither, except with great cost and trouble; to economize these, therefore, great skill and attention were required. It was necessary to study to avoid those large and expensive materials of which the Romans were so lavish, and to adopt the simplest and easiest forms of construction.

The first vaults tried were simple semi-circular tunnel-vaults. It was found that these, besides being very gloomy, required very massive walls to resist their thrust. An attempt was then made to relieve this thrust by *tranverse arches* thrown across—at intervals—under the tunnel-vault, to act as strengthening arches. Buttresses with a slight projection were applied outside to support these, and a beam of wood was sometimes introduced at the wall-head from buttress to buttress to assist in opposing the thrust of the vault.

This was the first attempt to throw the weight of the vault on single points. In the side-aisles, where the span was small, the Roman intersecting vaults were used: and as the roofs with tunnel-vaulting were found very gloomy and ill-lighted, it was desirable that similar intersecting vaults should be used to cover the main roof, in order to admit windows raised to light the vaulting. But how was this to be managed with the small

materials at command? If the transverse arches AB, CD (fig 1) are semi-circular, and the side-arches AC, BD the same—the vault being formed by two intersecting cylinders—then the intersecting groins AD and CB must be elliptical. This was a difficult form of construction: the mediæval builders found it easier to construct semi-circular groin arches with radius of one-half AD, and to fill in the triangular spaces ABE, etc., with slightly domed vaults. Here, then, we have the origin of the groin-rib, the development of which played so important a part in Gothic vaulting. When the space to be covered was square, this form of vault was found to answer, and usually included two bays of the side-aisles. But this arrangement looked awkward externally, the windows of the clerestory not grouping well with those of the side-aisles. A transverse arch was then introduced, carrying up the design from the nave piers to the vaulting. This form of vault is called hexapartite. All the above forms of vaulting were fully developed in the round arched styles of the Rhine.

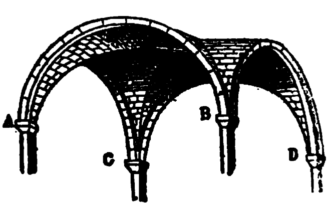


FIG. 1.

In France these forms were also tried; but it was found that the semi-circle is not a good form of arch unless loaded on the haunches, many of the churches which were vaulted in this manner during the 11th c. having to be buttressed or rebuilt in the 12th and 13th centuries. In the s. of France (where the Byzantine influence had been strongly felt through the Mediterranean commerce), the pointed tunnel-vault had been long in use, and had superseded the semi-circular tunnel-vault probably as early as the 9th or 10th century. This form of arch was thus probably suggested to the architects of the n. of France, who at once saw how well it would overcome the difficulty of the yielding of the haunches in the semi-circular arch. They were thus led to the adoption of the pointed form for their transverse arches *as a structural expedient*, and still retained the semi-circular form in the groins. The next question which engaged attention, and the solution of which led to the further use of the pointed arch, was the vaulting of oblong spaces. This had been tried with semi-circular arches, but it was found that in this way the vault would require to be very much domed—the diameter of the side arches being so much smaller than of the transverse—whereas by using pointed arches, of different radii, for the transverse and side arches all might be kept to about the same height (figs. 2 and 3). This is more fully explained by fig. 2. If AB be the diameter of the transverse arch, and AC that of the side arches, it is clear that the semi-circular side arch ADC cannot reach the height of the transverse arch AEB, even when stilted as at D′. But in the pointed arch, CEB, the same diameter rises to very nearly the height of the transverse arch. The pointed arches ACB and A′CB′ (fig. 3) show how easily arches of this form, whatever their diameter, can be built of the same height. By the introduction of this new form of arch the vaulting was strengthened, and the thrust brought to bear steadily on single points. We have thus traced the history of vaulting from the time of the Romans to the 12th c., when the principles of Gothic pointed vaulting were fully developed; and we have dwelt particularly on this subject, because it includes the principles which regulated the whole of the Gothic style. Gothic was not the invention of an individual, but a necessary growth—a gradual development from structural requirement. This is clearly the case with regard to the vaulting, as we have traced it above, and the same might be proved regarding every member of the style. Thus it might be shown how the ribs became gradually more decided, expressing the part they bore in the support of the roof; how the nave piers (q.v.) were gradually subdivided into parts, each shaft bearing on a separate cap a separate portion of the vaulting; how the buttresses were developed as they were required to resist the thrust of the groins concentrated on points; and how the flying buttresses were forced upon the Gothic architects much against their will, as a mode of supporting the arches of the roof.

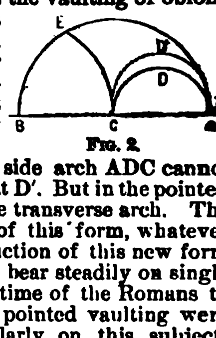


FIG. 2.

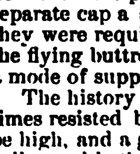


FIG. 3.

The history of the latter is very curious. The thrust of the tunnel-vault was sometimes resisted by half tunnel-vaults over the side-aisles. These, therefore, required to be high, and a gallery was usually introduced. In the Narthex at Vezelay we have this gallery with the vaulting used as a counterpoise to that of the nave. This is a fine example of vaulting in the transition state, the vaulting of the gallery resists the main vault, and is at the same time groined. This leaves rather a weak point opposite the transverse arches, and to strengthen these, flying buttresses are introduced, which timidly show themselves above the roof. The galleries were, in later examples, dispensed with to admit of larger clerestory windows, and the flying-buttresses were left standing free. The architects finding them indispensable, then turned their attention to render them ornamental. *Pinnacles* may also be shown to owe their origin to their use: they acted as weights to steady the buttresses and piers. We shall, under their separate heads, point out how each element of Gothic architecture was in the strictest

sense constructional, the decoration being in harmony with its actual use, or as Pugin has said, "decorated construction not constructed decoration."

The full development of Gothic vaulting, which was the forerunner of the whole style, was first carried out in the royal domain in France about the middle of the 12th century. The Normans had settled in the n. of France more than a century before this, and had applied their talents and the fruit of their conquests to the building of splendid temples in honor of their victories. In doing so, they followed out the round-arched style, and brought it forward by a great stride towards true Gothic. See NORMAN ARCHITECTURE.

South of the royal domain, in Burgundy, there had existed for centuries great establishments of monks, famous for their architecture. The abbey of Cluny was their central seat, whence they sent out colonies, and built abbeys after the model of the parent one. The style in which they worked was also an advanced Romanesque, but different from that of the Normans.

Between these two provinces lay the royal domain. Owing to the weak state of the kingdom, architecture had hitherto made little progress in the isle of France. About the beginning of the 12th c. the monarchy revived, and for the next two centuries was governed by wise and powerful monarchs, who succeeded in re-establishing the royal supremacy. A new impulse was thus given to the literature and arts of the country, by which architecture profited largely. From the state of ruin into which the kingdom had fallen, there were almost no churches existing worthy of the new state of things. New and great designs were formed: hitherto, almost all the important churches of France were abbey churches; now, under the royal patronage, cathedrals were to be built. The bishops, envious of the power of the monks, lent their powerful aid, and the whole of the laity joined heartily in the work. With such a universal impulse, no wonder that architecture took a great stride, and new forms were introduced. It is to this period and people that we owe the development of the true or pointed Gothic style.

At Vezelay the Burgundian monks had nearly approached to the Gothic. To complete the development, it only required the side-walls and vaulting of the nave to be raised, so as to admit of windows over the roofs of the side-galleries; and the flying buttresses to be raised with them, so as to receive the thrust of the vault—the latter being constructed with pointed groin ribs, and the side and transverse arches carried to the height of the groins. The laic architects of the royal domain soon accomplished this step, and the new style sprung up and progressed with the most astonishing rapidity.

The earliest example we have of the fully developed Gothic style is the cathedral of St. Denis, in which are deposited the remains of the kings of France. It was founded by the abbé Suger in 1144. The cathedral of Notre Dame of Paris soon followed, and almost contemporary with it arose the magnificent cathedrals of Chartres, Rheims, Amiens, Beauvais, Bourges, and a host of others.

Another cause which tended much to hasten the progress of the style, was the invention about the same time of painted glass. The Romanesque architects had been in the habit of decorating their churches with frescos and other paintings; but this new mode of introducing the most brilliant colors into their designs was at once seized upon by the northern architects. The small circular-arched windows, which were still in many instances retained long after the pointed-arch had become usual in the vaulting, no longer sufficed to light the churches when filled with stained glass. They were therefore enlarged, two or even three were thrown into one, divided only by mullions; this compound window was again increased until the compartment of the clerestory became almost wholly absorbed. The architects were then forced to conform the arches of their windows to the pointed outline of the side-arches of the vaulting. This desire for more and more space for stained glass was the origin of the window-tracery, which forms so beautiful a feature of the style. It is the last attenuated remains of the wall space of the clerestory, which was at last entirely absorbed.

Notre Dame, is a good illustration of the progress of French Gothic; the clerestory windows are small; and, in order to give more light, the vault of the gallery next the window is kept very high. This was the original design; but during the construction of the cathedral, the importance of stained glass had become so great, that the design was altered to give larger windows for its display. These windows also show the simple early forms of tracery; that in the aisle windows being later and more advanced. Tournay cathedral is a good specimen of the mode in which the whole space of the side-walls was made available for window tracery and stained glass.

The further history of Gothic architecture in France is simply the following out, to their furthest limits, of the principles above indicated, on which the early architects had unconsciously been working when they originated the style. So long as the Gothic architects worked on these principles they advanced and improved their architecture. When, however, the style had become fully developed and matured (about 1300 A.D.) the spirit of progress died. No new features were developed. The architects seemed to think that in its main elements their style was complete, and contented themselves with continuing the traditional style of their forerunners, pushing to their extremest limits the principles handed down to them. Thus, the height of the cathedrals was extended till, at Beauvais, it exceeded the power of the architects to prop up the vault-

ing. The system of buttresses and pinnacles was developed with the utmost skill, till at last the original simplicity and repose of the designs were lost, and the exteriors presented an elaborate system of scaffolding and propping-up in stone. The beautiful forms of the early tracery became distorted into all manner of flowing curves, graceful but unmeaning, of the Flamboyant period (q.v.); and, in short, the art became lost in mere cleverness of design and dexterity of execution, and the architect's place was usurped by the freemason.

It is in the cathedrals of the 12th and 13th centuries, above referred to, that we find the noblest development of the Gothic style. Everything tended to make them so. The nation was united in the effort—all the science, all the arts, all the learning of the times were centered in the church. In it, and that almost exclusively, the sculptor, the painter, the historian, the moralist, and the divine, all found scope for the expression of their ideas on the sculptured walls, porches, and niches, or the painted windows of the cathedrals—the churches of the people.

The progress of this style in other countries is no less remarkable. At no time in the world's history did any style of architecture ever spread so wide, or give rise, in so short a time, to so many splendid buildings. No sooner had the style been invented in the central provinces of France, than it immediately spread over the whole of the west of Europe, superseding all other styles, and producing similar splendid buildings wherever it went.

We will note shortly a few of the peculiarities of the style in England, Germany, and Italy. It spread also over the s. of France and Spain; but the latter countries have not yet been fully illustrated.

English Gothic.—The Normans introduced their round-arched style at the Conquest in 1066, and there are some fine specimens of this style both in England and Scotland—St. Cross, Hampshire; Durham cathedral; Kelso and Jedburgh abbeys, etc. But these buildings are not copies of those of Normandy. The English have always, in adopting styles, given them a national impress. As it was with the Norman, so it was to a still greater degree with the pointed Gothic. This was introduced into England about 1174, by William of Sens, who superintended the rebuilding of Canterbury cathedral. The English architects soon began to follow out a pointed style of their own. They borrowed much from France, and worked it out in their own way, forming what is now called the *early English* style. The differences between the early Gothic of France and England extend to almost every detail. The moldings, bases, caps, pinnacles, buttresses, and foliage of the latter are all impressed with the early English feeling. In France, the feeling of the early Gothic is one of unrest—a constant struggle forward. In England, the effort for progress is not so marked—that of carefulness and completeness prevails. In the *plans* of the cathedrals the differences are marked. The termination of a French cathedral or church is invariably circular ended or apsidal—a form derived from the circular tomb-house or baptistry, which in early Christian times was built separately, and afterwards taken into the cathedral. The English cathedral, on the contrary, is almost always square ended. The French transepts have almost no projection; the English ones have great projections—Salisbury and Canterbury having *two* transepts. The French cathedrals are short and very lofty; the English, long and comparatively low. The French buildings are perhaps the grandest and most aspiring, the English the most finished and picturesque.

The exterior of the chevet was a difficulty with the French and Germans, and, as at Beauvais and Cologne, resembles an intricate and confused mass of scaffolding. This difficulty was avoided by the English square ends, which afforded scope for the very English arrangement of the "five sisters" at York, or for a large field of stained glass in a single window.

The western portals of the French cathedrals, such as Rheims and Amiens, are among the boldest and most magnificent features of their architecture. In these the English were not far behind, as the western portals of Peterborough and York show.

The outlines of the English cathedrals are usually very picturesque and well balanced, the western towers grouping harmoniously with the central, and in this respect the English have the advantage.

In the application of vaulting, the English carried out their own ideas. They were always fond of wooden roofs, and probably this may have ledto the invention of the many beautiful kinds of vaults which form so fine a feature of English Gothic (see VAULTING, FAN-TRACERY). In England the style lasted longer than on the continent.

The Germans were nearly a century in adopting the pointed style after its invention in France; and when it was introduced, it retained the appearance of a foreign importation. It never was so completely naturalized as in England. The so-called beauties of the German Gothic are, for the most part to be regarded rather as excellent specimens of masonry than as artistic developments of the style. The open-work spires, for example, are fine pieces of construction, and have a striking effect; but from the first there is a tendency to commit the work to masons, who rejoice in displaying their manual dexterity. The later Gothic in Germany is the most splendid development of the stone-cutter's art and the draughtsman's ingenuity; these run riot, while the artist is entirely wanting.

The Gothic style forced its way also into classic Italy, but there it was never under-

stood nor practiced in its true spirit. It was evidently an imitation from the beginning. The Italian architects tried to vie with those of the n. in the size of their building, some of which, as San Petronio at Bologna, and Milan cathedral, are enormous. The former illustrates the defects of Italian Gothic. The arches are very wide, and there are few piers. There is therefore a bare and naked effect, which is not compensated for by any richness of sculpture or color. There is a want of *scale* about Italian Gothic buildings, as there is about those of Italian classic architecture both ancient and modern. Size alone is depended on for producing grandeur of effect. There is no attempt made to mark the size, and give a scale by which to judge of the dimensions of the buildings in those styles. A large classic temple is simply a small one magnified. In true Gothic architecture the case is different. Not only are the general dimensions magnified in a large edifice, but also the parts are multiplied. The columns and shafts remain of the same size, but their number is increased. The arches are enlarged in proportion to the general dimensions, but the caps, bases, and moldings remain of the same size as in a smaller building, and thus indicate the greater size of the arch. A true Gothic building of large dimensions thus tells its own greatness, but in a classic or Italian Gothic edifice the size has to be found out. Stained glass was little used in Italy. It may have been intended to decorate the walls with frescos—as indeed is the case in a few examples. The church of St. Francis, at Assisi, is the most remarkable building of this kind, and is a most interesting example of fresco-decoration.

The towns of Italy, being early enfranchised, have many municipal buildings in the Gothic style. These will be treated along with those of Belgium hereafter. See MUNICIPAL ARCHITECTURE.

We might, in the same manner, trace the Gothic style in all the other countries of western Europe; but its history is similar in all. It is in England and France that the true spirit of the style was most felt, and the finest examples remain. Our space has not permitted us to enter minutely into the various styles of Gothic in each country. The more important of these will be treated separately. See EARLY ENGLISH, DECORATED, PERPENDICULAR, FLAMBOYANT.

We may, however, state generally, that both in France and England the style had a complete existence—it was born, arrived at maturity, and died. When the spirit of the early architects had pushed the design to its utmost limits, they rested from their labors, well satisfied with their splendid achievements. Their successors occupied themselves with forms and details, and with the perfecting of every minute part. The art finally passed away, and left architecture in the hands of trade corporations—masons, carpenters, plumbers, etc.—who monopolized the whole work, and acted independently to the exclusion of one directing mind. The result was as we have seen: architecture became masonic skill, and Gothic was finally superseded by the revival of classic architecture in the 16th century.

GOTHIC LANGUAGE AND LITERATURE. The words Goth and Gothic have a somewhat vague signification, being popularly associated with much legendary history and many rash ethnological speculations. In early times they were used contemptuously to designate anything deemed mediæval or romantic as opposed to classical. Such a use of the Gothic name must be carefully distinguished from the history of the true national Goths who played so great a part in Europe from the 3d to the 8th c. of the Christian era, and who may, on many grounds, claim a foremost place among the Teutonic nations which had so prominent a share in the overthrow of the Roman empire. They were among the earliest of those nations to establish themselves within the empire, and no other Teutonic people has left behind it such early remains of a written literature. The wonderful thing is that a people who played so great a part for several ages should have wholly passed away. Not for many ages have they existed anywhere as a distinct nation, nor have they given an abiding name to any part of Europe. Their first certain historical appearance was in the lands north of the lower Danube in the 3d c. of our era; for any earlier account of them we must resort to traditions and myths, as confusing as they are abundant. Of the character of the Gothic language our earliest direct evidence is in fragments of a translation of the Bible and some other religious writings, which, although preserved in manuscripts not dating further back than the 5th c., and clearly written in Italy during the rule of the east Goths, are commonly assumed to have originated among the west Goths in Mœsia, and to be older by a century than the manuscripts themselves. The Finnish tribes, originally dwelling in the interior of Russia, borrowed numerous words from the Gothic at a much earlier day, and from a careful examination of these some conclusions have been drawn regarding a more archaic state of the language. Some of these words, it may be safely assumed, still retain forms of the Gothic language from as early a period as the 1st or 2d c. B.C—Ulfida, a Gothic bishop, who lived in the 4th c. of our era, invented an alphabet of twenty-four letters based on the Greek, and translated into Mœso-Gothic the whole Bible except the Book of Kings. Only fragments of this version are now in existence, though it was in constant use among the Goths while they retained their nationality. These fragments embrace the greater part of the gospels, considerable portions of the epistles, and a few remnants of the Old Testament. There are besides a few fragments of a commentary on John's gospel, and part of a Gothic calendar, giving the name of the

Gothic people as *Gut-thiuda*, from which it may be inferred that the Goths called themselves *Gutos*. The language as known to us, although very archaic in many of its forms and sounds, is still far removed from the original features of the common language as spoken before any separation of the Teutonic tribes had taken place. Most nearly related to it seem to have been the Scandinavian languages, which are now generally assumed to have formed, together with Gothic, the so-called eastern branch of the Teutonic family, while English, Frisian, and low and high German belong to a western division. The latter is chiefly marked by the introduction of a considerable number of forms and sounds of a less archaic stamp, while the eastern idioms are found to have adhered more closely to the original forms.

GOTHLAND (Swed. *Gottland*), an island in the Baltic, lying between 57°—58° n. lat., and 18°—19° 30' e. long., which, with Faröe, Gotska, Sandöe, and other smaller islands, constitutes the Swedish læn or province of Gottland and Wisby. Pop. '76, 54,649; and the superficial area about 1200 sq.m. Chief town, Wisby (q.v.). Gothland consists mainly of terrace-like slopes of limestone formation, encircled by cliffs which are broken by numerous deep fiords, more especially on the w. coast of the island, the eastern parts of which are flat. The surface is in many parts hilly and well wooded, and the soil is fruitful and well cultivated. The climate is sufficiently mild to allow of the grape and mulberry ripening in favorable situations in the open air. The land is divided among many small proprietors, who live in separate and detached homesteads. The island of Gothland was for ten years (from 1439 to 1449) the self-elected place of banishment of king Eric X., who, after long-continued dissensions with his Swedish and Danish subjects, retired to Wisby, where he shut himself up in the castle with his favorite mistress and a band of followers. Having refused to resume his duties, he was declared to have forfeited the crowns of Sweden and Denmark, and thenceforward he subsisted by pillaging the ships and infesting the coasts of the lands he had formerly governed. The remains of numerous churches and monasteries in every part of the island attest its former wealth, and afford many noble specimens of Gothic architecture. The name Gothland or Gotland (q. v.) is also used to indicate the southern division of the kingdom of Sweden, including eleven provinces besides the island of Gothland.

GOTHOFRED, or GODEFROY, the name of a noble French family, of which many members attained distinction as jurists or historians. The first, whose name is associated with the active study of jurisprudence, at the close of the 16th c., was DENIS GODEFROY, 1549–1621. He studied law at the universities of Louvain, Cologne, and Heidelberg. Having embraced the reformed religion, he found Geneva a safer abode than Paris, and became professor of law there. Some years afterwards he obtained a public appointment in one of the districts in the Jura, but was driven from his home by the troops of the duke of Savoy and retired to Basel. Thence he was induced by the offer of a chair of Roman law to go to Strasburg, but soon changed his appointment for one at Altorf, which then possessed a university celebrated for its late professor of law, Donneau. In 1600 the elector palatine appointed him professor of Roman law in Heidelberg, where he spent the greater portion of the remainder of his life, and was placed at the head of the faculty of law. The most flattering offers from several universities failed to induce him to leave his adopted country, but the invasion of the palatinate by Tilly's troops forced him to take refuge again at Strasburg, where he died. His most important work is his edition of the *Corpus Juris*. The text given by him was very generally adopted and used in quotation. More than twenty editions of the work were published in various towns of France, Germany, and Holland. Godefroy's other writings are very numerous; but they are for the most part either editions of classical authors or compilations which display great industry and learning, but are of little use to the modern student. THEODORE GODEFROY, 1580–1649, the eldest son of Denis, forsook the religion which his father had adopted, and obtained the office of historiographer of France, as well as several important diplomatic posts. His historical works are very numerous. The character of his labors will be judged from the title of his most elaborate production, *Le Ceremonial de France*. Many of his smaller works are devoted to questions of genealogy. JACQUES GODEFROY, 1587–1652, the younger brother of Theodore, has a real claim to the remembrance of students of the history of Roman law in his edition of the *Theodosian Code*, at which he labored for thirty years. It was this code, and not the *Corpus Juris* prepared under the direction of Justinian, which formed the principal though not the only source from which the lawyers of the various countries which had formed the western empire drew their knowledge of Roman law, at all events until the revival of the study of law in the 11th c. at Bologna. Hence, Godefroy's edition was of real value. Jacques Godefroy also completed the difficult and useful task of collecting and arranging those fragments of the *Twelve Tables* which can be discovered, and so an important step was taken towards representing the Roman law in its first definite form. His other works are very numerous, and are principally devoted to the discussions of various points of Roman law. He served the republic of Geneva both as its principal magistrate and in undertaking important missions to the court of France. [Extracted from *Encyc. Britannica*, 9th edition.]

GOTHS (Lat. *Gothi*, *Gothones*, *Guttones*, *Gutæ*, etc.; Gr. *Gotthoi*, *Gottoi*, *Goutthoi*, *Guthōnes;* Gothic, *Gutthiuda*), the name of a powerful nation of antiquity, belonging to the Germanic race. By some writers they are thought to have had a Scandinavian origin, which was the belief of their own historian, Jornandes. Indeed, Jornandes, Procopius Capitolinus, and Trebellius Pollio identified them with the Getæ, a branch of the Thracian group of nations; but later researches, especially those of Dr. Latham, leave it almost without a doubt that the Goths were originally Germans. The earliest notice of them extant among the writers of antiquity is that of Pytheas of Marseille, who lived about the time of Alexander the Great, and wrote a book of travels, some fragments of which have been preserved in the works of other writers. In one of these fragments, we find mention made of a tribe of *Guttones* bordering upon the Germans, and who lived round a gulf of the sea called Mentonomon, a day's sail from the island of Abalus, where they used to gather amber, and sell it to the neighboring Teutones. This gulf, there is every reason to believe, was the *Frisches Haff*, situated on the Prussian shore of the Baltic. The next notice that occurs of the Goths is in the *Germania* of Tacitus in which they are called Gothones, and are represented as dwelling beyond the Lygii; in the same direction, that is, as the one pointed out by Pytheas, though not on the sea-coast. Tacitus also distinguishes them from the Gothini, a tribe e. of the Quadi and Marcomanni, and who are represented by him as using the Gallican tongue. The Gothones, according to this historian, were under regal government, and on that account not quite so free as the other tribes of Germany, but still they enjoyed a considerable amount of liberty. The tribes next beyond them, and dwelling immediately on the sea-coast, were the Rugii and Lemovii, whose form of government was also monarchical, and their weapons, like those of the Gothones, round shields and short swords.

We next hear of the Goths as settled on the coast of the Black sea, about the mouths of the Danube, early in the 3d century. But at what time, or under what circumstances, their migration from the Baltic to the Euxine took place, it is impossible to ascertain "Either a pestilence or a famine," says Gibbon, "a victory or a defeat, an oracle of the gods or the eloquence of a daring leader, were sufficient to impel the Gothic arms on the milder climate of the south." In their new home, which was also the country of the Getæ (whence, perhaps, the error that confounded them with that people), the Goths increased both in numbers and strength, so that, as early as the reign of Alexander Severus (222—235 A.D.), they made some formidable inroads upon the Roman province of Dacia. In the reign of Philip (244—249 A.D.), they ravaged that province, and even advanced to the siege of Marcianopolis in *Mœsia Secunda*. The inhabitants ransomed their lives and property by a large sum of money, and the invaders withdrew for a time to their own country. Under Decius, however, they again entered Mœsia to the number of about 70,000, led by a king named Cniva. Decius himself advanced to meet them, and found them engaged before Nicopolis. On his approach, they raised the siege, and marched away to Philippopolis, a city of Thrace, near the foot of Mount Hæmus. Decius pursued them by forced marches; but at a convenient opportunity, the Goths turned with unexampled fury upon the Roman legions, and utterly defeated them. Philippopolis next fell before them by storm, after a long resistance, during which, and the massacre that followed, 100,000 of its inhabitants are reported to have been slain. This was in 250 A.D. In the following year, another tremendous battle took place near an obscure town called Forum Trebonii, in Mœsia, in which the Romans were again defeated with great slaughter, the emperor Decius and his son being in the number of the slain. The succeeding emperor, Gallus, purchased their retreat by an immediate present of a large sum of money, and the promise of an annual tribute for the future. The Goths now set themselves to the acquisition of a fleet, and with this, in 253, advanced to the conquest of Pityus, a Greek town on the n.e. coast of the Black sea, which they completely destroyed. In 258 they besieged and took Trebizond, when a great fleet of ships that were in the port fell into their hands. In these, they deposited the booty of the city, which was of immense value; chained the robust youth of the sea-coast to their oars; and returned in triumph to the kingdom of Bosphorus. In the following year, with a still more powerful force of men and ship, they took Chalcedon, Nicomedia, Nice, Prusa, Apauræa, and Cius. In a third expedition, which numbered as many as 500 vessels, they took Cyzicus, then sailed down the Ægean, ravaged the coast of Attica, and in 262 anchored at the Piræus. Athens was now taken and plundered, and many other renowned places in Greece were either partially or wholly destroyed. Even Italy was threatened; but, says Gibbon, "the approach of such imminent danger awakened the indolent Gallienus from his dream of pleasure." The emperor appeared in arms; and his presence seems to have checked the ardor, and to have divided the strength of the enemy. A portion of the Goths now returned to their own country. But in 269 they again started on a maritime expedition in far greater numbers than ever. After ravaging the coasts both of Europe and Asia, the main armament at length anchored before Thessalonica. In Claudius, the successor of Gallienus, however, the Goths found a far abler general than any they had yet contended with. This emperor defeated their immense host, said to number as many as 320,000 men, in three successive battles, taking or sinking their fleet, and after an immense slaughter of their troops, pursuing such as escaped until they were

hemmed in by the passes of Mount Hæmus, where they perished for the most part by famine. This, however, was only a single reverse. Aurelian, the successor of Claudius, was obliged to cede to them, in 272, the large province of Dacia, after which there was comparative peace between the combatants for about fifty years. In the reign of Constantine, their king, Araric, again provoked hostility, but was obliged eventually to sue for peace with the master of the Roman empire. Under Valens, they once more encountered the Roman legions, with whom they carried on a war for about three years (367—369) with tolerable success. They now began to be distinguished by the appellations of Ostro-Goths and Visi-Goths, or the Goths of the e. and w., the former inhabiting the shores of the Black sea, and the latter, the Dacian province and the banks of the Danube. On the irruption of the Huns, the Visigoths sought the protection of Valens against those barbarians, and in 375 were allowed by him to pass into Mœsia, to the number of about 200,000. Great numbers of them also now took service in the Roman army; but a dispute soon arose between the Goths and their new allies, which led to a decisive battle, in 378, near Adrianople, in which the emperor Valens lost his life. The Goths now threatened Constantinople, but were not able to take it; and during the reign of Theodosius, there was again a period of comparative peace.

Henceforward, the history of the Visigoths and Ostrogoths flows in two rather divergent streams. Before tracing either of these, however, it should be mentioned that the Goths, for the most part, became converts to Christianity about the middle of the 4th c., adopting the Arian form of belief, in accordance with the instructions of their renowned teacher and apostle, bishop Ulfilas. Here, also, it may be stated that the term Mœso-Goths, was applied to certain of the western Goths, who having settled in Mœsia, there devoted themselves to agricultural pursuits, under the protection of the Roman emperors.

Visigoths.—Upon the death of Theodosius the Great in 395, and the partition of the empire between Honorius and Arcadius, the renowned Alaric, king of the Visigoths, sought the command of the armies of the eastern empire, and upon being refused, invaded Greece with an army of his countrymen. About 400 he invaded Italy, took and pillaged Rome (410), and was preparing to carry his arms into Sicily and Africa, when his career was arrested by death. See ALARIC. Alaric was succeeded in the sovereignty by Athaulf (410–415), who, having married Placidia, the sister of Honorius, withdrew from Italy into the s. of Gaul, and about 412 crossed the Pyrenees into Spain. Athaulf was assassinated at Barcelona, and his successor, Sigeric, dying the same year, the choice of the Goths now fell on Wallia (415–418), who extended his power over a great part of southern Gaul and Spain, and made Toulouse his capital. The Goths, under this monarch, greatly assisted the Romans in their contests with the Vandals and the Alani. Wallia was succeeded by Theodoric I. (418–451), son of the great Alaric. He lost his life in the bloody engagement of Châlons-sur-Marne, leaving the throne to his son Thorismund (451–452), who, however, was assassinated by his brother Theodoric II. (452–466), who reigned for some years, but was at length himself assassinated by his brother Euric (466–483), whose reign was unusually brilliant and successful. He extended the sovereignty of the Visigoths considerably both in France and Spain, introduced the arts of civilization among his subjects, and drew up for their use a code of laws, in which were embodied many sound principles of jurisprudence. Under his successors, Alaric II. (483–506) and Amalaric (506–531), however, the kingdom of the Visigoths declined before that of the Franks. The former fell by the hand of Clovis in battle in 507, and the latter was killed either in battle or by the hand of an assassin in the year 531. Under his successor Theudes, the rule of the Visigoths was confined exclusively to Spain. Theudes was in his turn assassinated in his palace at Barcelona in the year 548. It will not be necessary to trace the long line of Visigothic kings that subsequently ruled in Spain from this period down to the year 711. The Visigothic power was completely broken, and their last king, Rodrigo or Roderick, slain by the Saracen invaders on the battle-field of Xeres de la Frontera.

Ostrogoths.—At the time when the Visigoths were admitted by Valens within the boundaries of the Roman empire, the same favor was solicited by the Ostrogoths, but was refused them by that emperor. They revenged themselves for this slight or injury by making frequent incursions into the Roman territories, sometimes on their own account, and sometimes as the allies of the Visigoths. In 386 the Ostrogoths sustained a severe defeat under their king or general, Alatheus, in attempting to cross the Danube, when many thousands of them perished, either by the sword of the Romans, or in the waves of the river. After this, they obtained a settlement in Phrygia and Lydia, but were ever ready to aid any fresh band of barbarians that prepared to assault the empire. Thus, they joined Attila in his renowned expedition against Gaul (450–453), and fell by thousands under the swords of their kinsmen, the Visigoths, at the battle of Châlons-sur-Marne. After this, they obtained a settlement in Pannonia, whence they pressed upon the eastern empire with such effect that the sovereigns of Constantinople were glad to purchase their forbearance by large presents of money. In 475 Theodoric, the greatest of the Ostrogoth sovereigns, succeeded to the throne upon the death of his father Theodemir. He directed his arms almost immediately against the eastern emperor Zeno; and having gained considerable advantages over him, obtained a grant of some of the richest provinces in the empire. Eventually, he was named chief of the

imperial guard, and indeed consul for the year 484. In 488, with the consent and advice of Zeno, he planned an immense expedition against Odoacer, king of Italy, who had held that title since 476, when he dethroned Augustulus, the last of the western emperors. Theodoric utterly defeated Odoacer, slew him, it is said, with his own hand, and reigned undisturbed sovereign of Italy until his death in 526. The seat of his empire was at Ravenna, which he sometimes exchanged for Verona, and once—i.e., in 500—he visited Rome, when he convened a meeting of the senate, and declared that it was his intention to rule the people committed to his charge with even-handed justice. To a great extent, he fulfilled this promise, and governed his subjects upon the whole wisely and to their advantage. The glory of his reign was, however, sullied by the execution of two of the most distinguished men of that age, Boethius and Symmachus, upon the plea that they were engaged in a conspiracy against him. During his reign, the Ostrogoth kingdom included, besides Italy, all the adjoining countries within the Rhone and the Danube; also the modern Bosnia, Servia, Transylvania, and Wallachia. In the disorders consequent upon the death of Theodoric, the emperor Justinian sought to win back Italy to the allegiance of the emperors of Constantinople; and for this purpose he dispatched Belisarius at the head of an army into that country. In 536, Belisarius entered Rome, which he held for his master, although invited by the Goths to become himself their king; but all his and his successor's efforts to subdue the Goths were at that time utterly fruitless. Totila (541–552), a noble Goth, was elected as successor to Vitiges, the antagonist of Belisarius, but was conquered in the battle of Tagina, by the imperial general, Narses, in the year 552. In that battle, Totila received his death-wound, and was succeeded by Teias, who did all that a brave man could to repair the misfortunes of his countrymen. It was to no effect, however, for he also was killed in battle in the following year, when "his head," says Gibbon, "exalted on a spear, proclaimed to the nations that the Gothic kingdom was no more." The Ostrogoths, broken and dispersed by their calamities, henceforward disappear from history as a distinct nation, their throne in Italy being filled by the exarchs of Ravenna; while the nation generally became absorbed in the indiscriminate mass of Alani, Huns, Vandals, Burgundians, and Franks, who had from time to time established themselves in the dominions of the old Roman empire.

GOTLAND (GÖTALAND, or GÖTARIKE), the most southern of the three old provinces or main divisions of Sweden (q.v.). Gotland is now divided into 12 læns or departments; it has a superficial area of about 37,000 sq.m., or one-fifth that of all Sweden, and a pop. of above 2,300,000. The greater part of the region, more especially in the n. and in the interior, is covered with mountains, forests, and lakes, but its southern districts contain some of the most fertile land in Sweden. The principal lakes are the Wener (q.v.) and the Wetter (q.v.). The river Göta, which was unfit for navigation on account of its cataracts, the most picturesque of which is Trollhättan, has been rendered navigable by the construction of numerous locks and canals, and it is now open to vessels of considerable burden from Gottenborg, on the Cattegat, to lake Wener, from whence the Göta canal extends the line (of 260 m.) of internal communication across the kingdom to its eastern shores. Gotland comprehends a large portion of the mining districts, and is especially rich in iron and alum, and yields good copper, nickel, coal, etc. The peasantry are superstitious, attached to their old traditional usages and their national costume, but are honest and industrious, hospitable and contented.

GOTTENBORG (Swed. *Göteborg*), next to Stockholm, the most important city of Sweden, in lat. 57° 41′ n., long. 11° 58′ e., and the principal town of the læn of Gottenborg. The pop., in 1874, was 63,748, exclusive of its extensive environs. Gottenborg, which was founded by Gustavus Adolphus in 1618, is situated on the river Göta, a few miles from the Cattegat, and consists of a lower and upper town; the former intersected by numerous canals, which are bordered by *allées* of fine trees, and spanned by numerous bridges; and the latter picturesquely scattered over the adjacent rocky heights. Its admirable harbor, which is protected by three forts, affords safe anchorage to ships of heavy burden, and has long been noted for its extensive foreign commerce. The upper parts of the town have wide and regular streets and good stone houses; but there are few buildings deserving a special notice excepting the new church, the exchange, the cathedral, the town-hall, and arsenal. Gottenborg is the see of a bishop, and the seat of the government of the district. It has good schools, one of them founded by Oscar I. for the children of soldiers; a public library; an academy of science and literature, which was incorporated in 1775; etc. The Göta canal, which connects the German ocean and the Baltic, brings Gottenborg into direct communication with Stockholm and a great portion of the interior of the kingdom, which its supplies with the products of foreign commerce and its own home-industry. The latter is of considerable importance, and includes, besides ship-building, extensive manufactories of woolen and cotton goods, sail-cloths, tobacco, snuff, glass, paper, sugar, and porter. In 1872, 3,961 vessels, of 1,147,032 tons, entered and cleared the port. The exports are iron, copper, deals, tar and pitch, alum, fish, etc.; and the imports, salt, cereals, wine, and articles of colonial trade. The great feature of the Gottenborg *licensing system*, which has acquired some notoriety in this country, is the elimination of private profit in the sale of spirits,

by having the public-houses conducted by managers paid by salary, while the profits are paid into the town treasury.

GOTTFRIED VON STRASBURG, or GODFREY OF STRASBURG, so called, it is believed, either from having been born, or from having resided in the town of Strasburg in Alsace, was one of the most eminent poets or *minnesingers* of the middle high-German period. He flourished during the latter half of the 12th century. His chief work, *Tristan*, in the composition of which he was employed at his death, and which extends to about 20,000 stanzas, was written about the year 1207, during the lifetime of Hartmann of Aue, whom he celebrates as the first of German narrators, and after the publication of the first portion of Wolfram von Eschenbach's *Parcival*, to the prologue to which he alludes. Eilhart of Oberge had worked up the story of *Tristan* from a French poem. Gottfried founds his story on another French poem (of which considerable fragments are still extant), and names as the author Thomas of Brittany, who, however, is not to be confounded with the half or wholly fabulous Thomas of Ercildoune, referred to in the old English story of *Tristan*, published by sir Walter Scott. Besides *Tristan*, some lyric poems by Gottfried are still extant. Gottfried's works, with later continuations of *Tristan*, were published by Von der Hagen (1823). An admirable edition of Gottfried has been furnished by Bechstein (1869; 2d ed. 1873). Modern German translations have been given by Kurtz and Simrock. Wagner has made use of *Tristan* for his opera *Tristan und Isolde*.

GÖT'TINGEN, a t. in the former kingdom of Hanover, in lat. 51° 31' n., long. 9° 56' e., and one of the pleasantest in lower Germany, is situated in a fruitful valley on both banks of an artificial arm of the Leine, called the New Leine, about 60 m. s. of Hanover. It is in general well built, but is almost destitute of fine edifices, and has an air of solitude, which even the number of students cannot dissipate. The *Rathhaus*, an old castellated and picturesque edifice; the educational institutions, of which there are many; the hospital, and the university, are the only buildings of any note. The university was instituted by George II., king of England and elector of Hanover, in 1734, and opened Sept. 17, 1737. Connected with it are the library, containing over 500,000 vols. and 5,000 manuscripts; the royal society, founded 1750, which publishes the well-known transactions and the *Göttinger Gelehrte Anzeigen;* the observatory; the art museum, with collections of old oil-paintings, of engravings, of coins and models of all sorts, and some casts from the antique; the lying-in hospital, the chemical laboratory, and the botanic gardens (laid out under Haller's superintendence in 1739), one of the chief ornaments of the town. From 1822–26, the number of students attending the university of Göttingen averaged 1481 annually; but in consequence of the troubles of 1831, the number in 1834 had fallen to 860. The university could, however, still boast a rare assemblage of distinguished teachers, such as Blumenbach, Dahlmann, Ewald, Gauss, Gervinus, Gieseler, Herbart, Lücke, Otfr, Müller, the brothers Grimm, etc.; but the expulsion in 1837 of the "seven professors," Albrecht, Dahlmann, Ewald, Gervinus, the two Grimms, and W. Weber, for political reasons, inflicted a blow upon the university from which it has never fully recovered. It has upwards of 100 professors of various grades, many of whom are men celebrated throughout Europe. The number of students in 1877 was 991. The chief manufactures of the town are hosiery, leather, and musical and scientific instruments; but the only flourishing trade of Göttingen consists in the sale of tobacco and tobacco-pipes, books, and sausages. Pop. '75, 17,057.

GOTTSCHALK, or FULGENTIUS, a prominent figure in one of the most important theological controversies of the 9th c., was the son of Berno, a Saxon count, and, having been devoted from infancy by his parents to the monastic life, was trained at the monastery of Fulda, during the abbacy of Hrabanus Maurus, and while Walafridus Strabus was a member of the fraternity. At the approach of manhood he made strenuous efforts to be released from his vows; and he actually succeeded in obtaining from a synod held at Mainz in 829 the necessary dispensation; but through the hostile influence of his abbot this was afterwards cancelled by Louis the Pious, though as a slight mitigation of the harshness of this treatment he was permitted to remove to the monastery of Orbais, in the diocese of Soissons. Here he devoted himself to ardent study of the writings of Augustine, with the result that he became an enthusiastic believer in the doctrine of absolute predestination, in one point going even beyond his master, Gottschalk believing in a predestination to condemnation as well as a predestination to salvation, while Augustine had contented himself with a doctrine of preterition as complementary to his doctrine of election. While returning from a pilgrimage to Rome in the year 847, Gottschalk, happening to pass a night at a hospice in Friuli, came into contact with Notting, the newly-elected bishop of Verona, and expounded to him his peculiar views. The bishop, apparently without saying much at the time, carried word to Hrabanus Maurus, who, meanwhile, had become archbishop of Mainz; the latter lost no time in issuing two letters, one to his informant and another to count Eberhard of Friuli, in both of which he denounced the opinions of Gottschalk with some recklessness and great violence. On the one hand he accused his adversary of neglecting the distinction between foreknowledge and foreordination; on the other hand, he himself refused to recognize any difference between predestination to punishment and predestination to sin. At a synod held in Mainz in presence of the emperor, in 848, Gottschalk presented

himself with a written explanation and defense of his views; he was, however, very summarily found guilty of heresy, and handed over to his ecclesiastical superior, Hincmar of Rheims, to be dealt with as his crime might deserve. Having again assumed the defensive in an assembly at Chiersy in 849, he was once more condemned—on this occasion not only as a heretic, but also as a despiser of authority, and as a disturber of the church's peace—and sentenced to be whipped severely and rigorously imprisoned. The place selected for his captivity was the monastery of Hautvilliers, in the diocese of Rheims, and here he languished throughout the remainder of his life, a period of 20 years, notwithstanding the efforts of influential friends and his own pitiful appeals. Prudentius of Troyes, Wenilo of Sens, and Florus of Lyons successively expressed opinions more or less in favor of his views; nor did Hincmar derive much real aid from the dialectical skill of Erigena, whom he had called in as an authority on the other side. Various synods met, reached widely discrepant opinions on the burning question, and ultimately postponed its settlement to a future council in less troubled times. The summons of pope Nicholas I., in 863, calling Hincmar to account for his harsh conduct, unfortunately never took effect; and the result was that, after many renewed attempts at conviction and persuasion on the part of Gottschalk—he even proposed to settle the question by ordeal of fire—he was suffered to die unheeded in 868, and by orders of his inhuman adversary was buried in unconsecrated ground. It may be added that Gottschalk had attempted to establish a counter charge of heresy against Hincmar, on account of the latter's substitution of *Sancta Dietas* for *Trina Dietas* in a current hymn. This was thought to savor of Sabellianism; but the orthodox bishop succeeded at once in purging himself from such an imputation of heretical depravity. [Extracted from *Encyc. Britannica*, 9th Edit.]

GOTTSCHALK, Louis Moreau, 1829–69; b. New Orleans, d. Rio de Janeiro. He showed great musical talent at an early age, and was sent to Paris when 12 years old to receive instructions from Hallé and Camille Stamaty on the piano, and from Maleden in harmony. He made his first appearance as a public performer in Europe, but in 1853 returned to America, playing in New York and other cities with much success. His execution, especially when playing his own compositions, was greatly admired, and in some of his pieces illustrating tropical life he has never been excelled. He composed over 50 pieces for the piano, of which the best known are *Lebananier*; *La savane; Ricordati; La marche de nuit; O ma charmanté; Le mancenillier; Réponds moi; Ojos criollos*, and a number of Cuban dances. His touch combined extreme delicacy with force and dash. His style of playing had a dreamy and sensuous charm that drew large audiences to his concerts, which were given in many cities of Europe, the United States, Mexico, South America, and Australia.

GOTTSCHED, Johann Christoph, a once popular German writer, was b. at Judithenkirch, near Königsberg, in Prussia, Feb. 2, 1700, and at the age of 14 entered the university of Königsberg with the intention of studying for the church, but he soon turned his attention to philosophy, the fine arts, and languages. In 1724 he removed to Leipsic, where in 1730 he became extraordinary professor of philosophy and poetry, and in 1734 professor of logic and metaphysics. He died Dec. 12, 1766. Gottsched's great merit lay in his endeavoring to make the German language the vehicle of instruction for his countrymen in literature and science. In other respects, he was essentially French; and his clear, calm, and "correct" understanding naturally led him to admire writers like Racine and Boileau, and to value elegance, precision, and purity of style more highly than all other merits. Gottsched executed a multitude of poems, critical and philosophical works, translations, etc. His tragedy, *Der Sterbende Cato* ("The Dying Cato"), which, in the days of its popularity, went through not less than ten editions, is now regarded by his countrymen as a frightful specimen of "correct" and watery verse. See Bodmer.

GOUDA (Dutch, *Ter Gouwe*), a t. of Holland, in the province of s. Holland, is situated on the right bank of the Hollandsche Yssel, where it is joined by the Gouwe, 11 m. n.e. of Rotterdam. It has a large market-place, consisting of a spacious square, which contains the town-house and the church of St. John. The latter building has 31 magnificent stained glass windows, gifted by Philip II. of Spain, Margaret of Austria, William I. Prince of Orange, and other high persons. They were executed between 1555 and 1603 by the brothers Crabeth and others, and are among the finest in Europe. Gouda is famed for its pipes. The clay used in this manufacture is brought from Coblenz and Namur. It has also numerous potteries, extensive brick and tile works. The bricks are called clinkers, and are much used in building and in paving. Gouda also manufactures cotton, woolen, and sail cloths, has rope-walks, gin-distilleries, breweries, and a famous cheese-market. There is a stearine-candle factory which, in 1874, employed 175 men and 250 women. Book-printing, making leather, and soap-boiling are also industries. Pop. '75, 16,576.

GOUDIMEL, Claude, 1510–72; one of the founders of modern music, claimed both by France and Belgium. In 1540 he was in Rome at the head of a music school, and among many other celebrated musicians, Palestrina, the greatest master of the early Italian school, and one of the greatest masters of all schools, was his pupil. About the middle of the c. he seems to have left Rome for Paris, where, in conjunction with

Jean Duchemin, he published, in 1555, a set of Horace's *Odes*, entitled, *Horatii Flacci odæ omnes quotquot carminum generibus differunt ad rhythmos musicos redactæ.* Infinitely more important is another collection of vocal pieces, a setting of the celebrated French version of the Psalms by Marot and Beza, published in 1565. It is written in four parts, the melody being assigned to the tenor. Some of the tunes are probably of popular origin, and they are still used by the French Protestant church. Others were adopted by the German Lutherans, a German imitation of the French versions of the psalms in the same meters having been published at an early date. There is little doubt that, at the time of the last-named composition, Goudimel had embraced the new faith, although the French version of the psalms was at first used by Catholics as well as Protestants. Seven years later he fell a victim to religious fanaticism during the St. Bartholomew massacres at Lyons.

GOUGH, HUGH, Viscount, 1779–1869; b. Ireland. He joined the British army, serving at the cape of Good Hope and in the peninsular war, being several times wounded. In 1830 he was made maj.gen.; was prominent in the opium war in China in 1841; afterwards served in several Indian wars against the Mahrattas and the Sikhs, Later in life he was a member of the privy council, and in 1862 was promoted to be field-marshal.

GOUGH, JOHN B., American temperance lecturer, was b. at Sandgate, Kent, England, August 22, 1817; his father, a pensioner of the Peninsular War; and his mother, a village schoolmistress. At the age of 12 he went to America as an apprentice, and worked on a farm in Oneida co., New York. In 1831 he went to New York City, where he found employment in the binding department of the Methodist book establishment; but habits of dissipation lost him this employment, and reduced him to that of giving recitations and singing comic songs at low grog-shops. He was married in 183C; but his drunken habits reduced him to poverty and delirium tremens, and probably caused the death of his wife and child. A benevolent Quaker induced him to take the pledge: and he attended temperance meetings and related his experience with such effect as to influence many others. In 1842 he had a short relapse into drunkenness; but an eloquent confession restored him to favor, and he lectured in various parts of America with great success. In 1853 he was engaged by the London temperance league to lecture two years in the United Kingdom, where he drew large crowds by his earnest, and by turns, amusing and pathetic orations. An autobiography and a volume of his addresses had a wide circulation. In 1878 he again visited England.

GOUJON, JEAN, 1520–72; a French sculptor, employed by Pierre Lescot, the celebrated architect of the Louvre, on the restoration of St. Germain l'Auxerrois; the building accounts specify as his work, not only the carvings of the pulpit (Louvre) but also a "Notre Dame de Piete," now lost. At the Louvre, Goujon, under the direction of Lescot, executed the carvings of the south-west angle of the court, the reliefs of the "Escalier Henry II.," and the "Tribune des Caryatides." About a year before the execution of the Caryatides, for which Goujon received 737 livres, he produced, according to unbroken tradition, the reliefs of the "Fontaine des Innocents" (Louvre, and *in situ);* after which he is supposed to have been occupied in work destined for the decoration of the chateau of Anet, then builder for Diana of Poictiers. In 1555 his name appears again in the Louvre accounts, and continues to do so every succeeding year up to 1561, when all trace of him is lost. In the course of this year an attempt was made to turn out of the royal employment all those who were suspected of Huguenot tendencies. Goujon has always been claimed as a reformer; it is consequently possible that he was one of the victims of this attack. We should therefore probably ascribe the work attributed to him in the hotel Carnavalet together with much else executed in various parts of Paris—but now dispersed or destroyed—to a period intervening between the date of his dismissal from the Louvre and his death (of which there is no evidence), which is said to have taken place during the St. Bartholomew massacre in 1572.

GOU'KEKA, GOTCHA, or SEVANG, LAKE OF, a deep inland lake of Russian Armenia, in lat. 40° 8′ to 40° 35′ n., and long. 44° 45′ to 45° 35′ e., 30 m. n.e. of Eriwan. It is 47 m. in length from n.w. to s.e., is 15 m. in average breadth, and is situated in a mountainous district at an elevation of 5,300 ft. above sea-level. The principal facts known about this lake are, that it is very deep, and yields good fish; that its banks abound in volcanic products; and that, without having any considerable outlet, it receives the waters of several streams.

GOULBURN, a city in New South Wales, 120 m. s.w. of Sydney, on the Great Southern railroad, near the junction of Wollondilly river and the Mulwaree ponds; pop. 8,500. The Roman Catholics and the Church of England have bishops here. Minerals are found near by, but the main business of the region is agriculture.

GOULBURN, EDWARD MEYRICK, D.D., b. England, 1818; educated at Oxford, where he was for some years a tutor, and at the same time held the incumbency of Holywell, Oxford. In 1850, he became master of Rugby school, and in 1858 prebendary of St. Paul's, and subsequently dean of Norwich. Among his works are: *The Doctrine of the Resurrection of the Body; Principles of the Cathedral System Vindicated; Thoughts*

on Personal Religion; Pursuit of Holiness; and *The Holy Catholic Church, its Divine Ideal, Ministry, and Institution.*

GOULD, Augustus Addison, 1805–66; b. N. H.; an American naturalist. His father's family name was Duren, but it was changed to Gould. He graduated at Harvard in 1825, and taking his medical degree five years later, entered into practice in Boston. During his college term he gave much attention to natural history, and after entering upon his professional career, was an instructor in botany and zoology in Harvard college for two years. In 1856 he was appointed visiting physician to the Massachusetts general hospital. As a naturalist he was eminent, especially so in the department of conchology. He was a frequent contributor to scientific periodicals, and author of works bearing the following titles: *Genera of Shells,* translated from Lamarck; *System of Natural History; The Invertebrate Animals of Massachusetts; Principles of Zoology; Mollusca and Shells of the United States; Exploring Expedition under Captain Wilkes;* completion of Dr. A. Binney's *Land Mollusks of the United States; The Mollusca of the North Pacific Expedition under Captains Ringold and Rogers,* and *Otia Conchologica.*

GOULD, Benjamin Apthorp, 1787–1859; b. Mass. He graduated at Harvard in 1814, and was principal of the public Latin school in Boston from that time until 1828, when the failure of his health compelled him to resign. He prepared for that school several text-books, especially a revised and improved Latin grammar, which had an extensive circulation. In the later period of his life, he filled several important public positions.

GOULD, Benjamin Apthorp, b. Boston, 1824; graduated at Harvard, 1844. After his graduation he went to Göttingen, where he pursued his mathematical and astronomical studies, and took his degree in 1848. He was for a time assistant in the observatory at Altona, and visited besides many of the observatories of Europe. In 1849 he established at Cambridge the *Astronomical Journal,* maintaining it until 1861, when it was suspended on account of the war. In 1851 he entered the coast survey, taking charge of the longitude determinations, to which the electric telegraph had just been applied by Bache and Walker. He made great improvements in the telegraphic methods, by means of which very important results were secured. In 1866, when the transatlantic cable had been completed, he established an observatory at Valentia in Ireland, and made the first determinations of transatlantic longitude by telegraph cable. In 1856 he was appointed director of the Dudley observatory at Albany, remaining at the post until 1859, when he retired on account of serious differences with the trustees. His action in the matters which led to the misunderstanding was afterwards justified by a committee of scientific men. His labors in the observatory were of great value, and performed without remuneration. In 1863 he took charge of the statistics of the sanitary commission. His researches while thus engaged were alike curious and important. In 1870 he went to South America, and established a national observatory for the Argentine Republic at Cordova, where he still remains (1880), and where his labors have been of the highest value to the cause of science. His principal publications are: *Report on the Discovery of the Planet Neptune; Investigation of the Orbit of Comet V.; Discussions of Observations made by the U. S. Astronomical Expedition to Chili, to determine the Solar Parallax; Discussion on the Statistics of the U. S. Sanitary Commission.* He has also published charts of the stars discovered from the observatory at Cordova.

GOULD, Hannah Flagg, 1789–1865; b. Mass. She wrote extensively for magazines and newspapers, and some of her verses were copied and admired in England. A volume of her poems appeared in 1832, a second in 1836, and a third in 1851. Her other works are: *Gathered Leaves* (prose sketches); *The Diosma,* composed partly of original and partly of selected poems; *The Youth's Coronal; The Mother's Dream, and other Poems;* and *Hymns and Poems for Children.*

GOULD, James, ll.d., 1770–1838; b. Conn. He graduated at Yale, served as justice of the supreme court of Connecticut, and for forty years was associated with Hon. Tapping Reeve as a professor in the Litchfield law school. He published, in 1832, *Principles of Pleading in Civil Actions.*

GOUNOD, Félix Charles, an eminent French operatic composer. He was b. in Paris in 1818, studied at the Conservatoire there under Halévy, and also under Lesueur and Pauer. Obtaining the first prize of the institute in 1839, he was sent to Rome to complete his musical education; and while there, devoted himself chiefly to religious music. On his return to Paris, he was for a time attached to the church of the Missions Etrangères, where his earliest compositions were performed: one of them, a *Messe Solennelle,* was the first work which brought him into general notice. For a time, he contemplated taking orders, and went through part of the preliminary novitiate. His first opera, *Sapho,* was produced in 1851; in 1852, he wrote choruses for Ponsard's drama of *Ulysse;* and in 1854 appeared his opera of *La Nonne Sanglante.* His comic opera, *Le Médecin malgré lui,* produced in 1858, was a great success; it was followed in 1859 by *Faust,* which at once attained a widespread European popularity, and raised its composer to the foremost rank of contemporary musicians. *Philémon et Baucis* followed in 1860; in 1862, *La Reine de Saba* (brought out afterwards in England as *Irene*), and *La Colombe;* in 1861, *Mireille;* in 1864, the oratorio of *Tobias;* in 1867, *Romeo and Juliet;* and

in 1878, *Polyeucte* was produced at the Grand Opera. In Gounod's compositions are to be found deep musical science, a profusion of new and original combinations, and an almost unequaled command of the resources of the orchestra. There is great dramatic power in his operas, and one of their marked features is the prominence given to declamation over melody.

GOURA, *Lophyrus coronatus* or *Columba coronata*, by far the largest of the pigeon family (*Columbidæ*), a native of Java, New Guinea, and other islands of the Indian Archipelago. It is 2 ft. 4 in. in length from the tip of the bill to the extremity of the tail. It is a very beautiful bird, of a grayish-blue color, parts of the back and wings black and purplish-brown, a broad white bar across the wings. The head is adorned with a large semi-circular crest of narrow straight silky feathers, always carried erect. The goura is in the highest esteem for the table, and might probably be domesticated with great advantage in tropical countries; but attempts which have been made to introduce it into the poultry-yards of Holland have completely failed owing to the climate.

GOURD, *Cucurbita*, a genus of plants of the natural order *cucurbitaceæ*, nearly allied to the cucumber; having male and female flowers on the same plant, the flowers large and yellow. The species are annual plants of very rapid growth; their leaves and stems rough; their leaves broad and lobed; their stems often very long and trailing; natives of warm climates, although the native region of the kinds chiefly cultivated is very uncertain, and they have probably been greatly modified by long cultivation, so that perhaps all of them may be forms of one original species, a native of some of the warmer parts of Asia. The COMMON GOURD or PUMPKIN (*C. pepo*), with smooth globose or pear-shaped fruit, varying from the size of a large apple to 50 or 70 lbs. in weight, is much cultivated both in gardens and fields in almost all parts of the world of which the climate is warm enough for it; and the fruit is not only a very important article of human food, but is also used along with the superabundant shoots for feeding cattle. In many countries, pumpkins are a principal part of the ordinary food of the poorer classes, and are much used even by the wealthy; they are not eaten raw, but dressed in a great variety of ways—as in pies, with apples, sugar, spice, etc., and sliced or fried with oil or butter, or made into soups, etc. Pumpkins are much cultivated in North America. In England, they are also cultivated, but not to a great extent, and never as food for cattle. It is not unusual for English cottagers to plant them on dunghills, and to train the shoots along the neighboring grass. The VEGETABLE MARROW (*C. ovifera* or *C. succada*) appears to be a mere variety of the pumpkin. It was introduced into Europe from Persia since the beginning of the 19th c., but is now more generally cultivated in Britain than any other kind of gourd, being one of the most hardy, and its fruit of excellent quality and useful for culinary purposes at almost every stage of its growth. When full grown, the fruit is elliptic, very smooth, generally about 9 in. long, and 4 in. in diameter; but these dimensions are generally much exceeded.—One of the most valuable gourds for culinary purposes is the GREAT GOURD (*C. maxima*); of which the Spanish gourd is a green-fruited variety; and the great yellow gourd, the largest of all, has yellow fruit, with firm flesh of a deep yellow color. It is sometimes fully 200 lbs. in weight, and 8 ft. in circumference. The form of the fruit is a somewhat flattened globe; when boiled, it is a very pleasant and wholesome article of food. It is much cultivated in the south of Europe.—The SQUASH (*C. melopepo*) differs from all these in generally forming a bush, instead of sending out long trailing shoots; also in the extremely flattened fruit, the outline of which is generally irregular, and its whole form often so like some kinds of cap, that in Germany one variety is generally known as the *elector's hat*, and the name *Turk's cap* is bestowed on another. The squash is regarded as one of the best gourds, and is much cultivated in some parts of Europe and North America. The WARTED GOURD (*C. verrucosa*), which has a very hard skinned fruit covered with large warts, and the MUSK GOURD (*C. moschata*), distinguished by its musky smell, are less hardy than the kinds already named; as is also the ORANGE GOURD (*C. aurantia*), sometimes cultivated on account of its beautiful orange-like fruit, which, however, although sometimes edible and wholesome, is not unfrequently very unfit for use, on account of colocynth developed in it. This is apt to be the case in some degree with other gourds also, but the bitter taste at once reveals the danger. The same remark is applicable to the young shoots and leaves, which, when perfectly free from bitterness, are an excellent substitute for spinach. In Scotland, even the most hardy gourds are generally reared on a hotbed and planted out. In England, it has been suggested that railway banks might be made productive of a great quantity of human food by planting them with gourds. Ripe gourds may be kept for a long time in a cool, well-ventilated place, nor are they injured by cutting off portions for use as required. The name gourd is often extended to many other *cucurbitaceæ*.

GOURD (*ante*), a term more narrowly applied in America than in England. In the latter country it includes all members of the order *cucurbitaceæ*, here only those of the genus *laginaria*. It is a well-known climbing plant bearing a large bottle-shaped fruit, the shell of which is almost as hard as that of the cocoanut, and is largely used in the southern states for water dippers. It is a native of Africa. One known as the orange gourd is cultivated in Texas for ornament.

GOURGUES, Dominique de, 1530–93; b. France; entered the army, served in Spain, was taken prisoner in Italy and condemned to the galleys, was taken by the Turks and rescued by the knights of Malta. He traveled in Asia, Africa, and South America. In 1567, he left France with three ships and a small force of men to punish the Spaniards for killing the French explorers in Florida. This, with the aid of an Indian chief, he effected, hanging the Spaniards on the trees from which they had suspended the French. For several years afterwards he lived in obscurity, but was at last restored to favor in France, and the king of Portugal put him at the head of a fleet to operate against Philip II. A complete history of this adventurer is given in Parkman's *Pioneers of France in the New World.*

GOURKO, Joseph Vladimirovitch, a Russian gen., b. Nov. 15, 1828. Entering the army as cornet of hussars of the imperial guard, he was created capt. in 1852, and in this capacity served in the Crimean war. In 1857, he was assigned to the command of the emperor's squadron in his old regiment of the guards, and in 1860 made an adjutant of the emperor. His next promotion was to a colonelcy, in which capacity he served in the campaign in Poland in 1863. In 1867 he was created a maj.gen. in the suite of the emperor, and assigned to the command of a brigade in the second cavalry division of the guards. In 1876 he was created lieut.gen. and put in command of the same division. At the head of an "advance corps," and leaving the main army behind, he made a rapid march to the Danube, thence to Tirnova, and finally beyond the Balkans, creating great consternation in the Turkish empire. He was afterwards forced to retreat to the Shipka pass, and was then ordered to return to St. Petersburg, where he was created adj.gen. and put in command of his own division.

GOUSSET, Thomas Marie Joseph, 1792–1866; b. France, of a peasant family. At the age of 25 he was made a priest, and soon became professor of moral theology in Besançon, holding the place 17 years. In 1825 he published a work, much in advance of most thinkers, on the relations of the church to usury. In 1836 he was appointed archbishop of Rheims, and in 1850 became a senator of France and a cardinal. His chief works are on dogmatic and moral theology.

GOUT (Fr. *goutte*, from Lat. *gutta*, a drop), a mediæval term of uncertain date, derived from the humoral pathology (see Rheumatism), indicating a well-known form of disease, which occurs for the most part in persons of more or less luxurious habits, and past the middle period of life. The acute attack of gout begins most commonly by a painful swelling of the ball of the great toe or of the instep, sometimes of the ankle or knee; much more rarely, it attacks both lower limbs at once; and more rarely still, it seizes first upon some other part of the body, the foot being either not attacked at all, or becoming involved at a later period. In the great majority of cases, the foot is not only the first part attacked, but the principal seat of the disease throughout; according to Scudamore, indeed, this is the order of events in not much less than four-fifths of the cases. In exceptional instances, the ankle, knee, hand, elbow, etc., are attacked at first; now and then, the disease smolders in the system in the form of disorders of the digestive or nervous functions, or oppression of the circulation for some considerable time before it takes the form of "regular" gout—that is, of an acute attack, or fit, of gout in the foot. The name podagra (Gr. *pod*, foot, and *agra*, seizure) indicates the leading character of the disease as apprehended by all antiquity; and the very numerous references to the disorder so called, not only in the medical writings of Hippocrates, Galen, Aretæus, Cælius Aurelianus, and the later Greek physicians, but in such purely literary works as those of Lucian, Seneca, Ovid, and Pliny, show not only the frequency, but the notoriety of the disease. The allusions, indeed, are of a kind which give ample proof that the essential characters of gout have not been changed by the lapse of centuries; it is caricatured by Lucian in his burlesque of *Tragopodagra* in language quite applicable to the disease as now observed; while the connection of it with the advance of luxury in Rome is recognized by Seneca (*Epist.* 95) in the remark that in his day even the women had become gouty, thus setting at naught the authority of physicians, which had asserted the little liability of women to gout. Pliny likewise (book 26, chap. 10) remarks upon the increase of gout, even within his own time, not to go back to that of their fathers and grandfathers; he is of opinion, further, that the disease must have been imported; for if it had been native in Italy, it would surely have had a Latin name. Ovid and Lucian represent gout as mostly incurable by medicine; from this view of it Pliny dissents. The list of quack remedies given by Lucian is one of the most curious relics of antiquity.

In the present day, gout is observed to prevail wherever there is an upper class having abundant means of self-indulgence, and living without regard to the primeval law of humanity, "in the sweat of thy face shalt thou eat bread." The directness, however, with which gout can be traced, in particular cases, to its predisposing causes is very various; and in many instances a well-marked hereditary tendency to the disease may be observed, which even a very active and temperate life can scarcely overcome; while, on the other hand, the most gross forms of excess may be practiced for a whole lifetime without incurring the gouty penalty. It is difficult to explain these variations; but they leave unaffected the general principle, that gout is a disease especially of the wealthy, and most of all of those who have little physical exertion, and

give great scope to the bodily appetites. The prevention and cure, accordingly, have been at all times recognized as being mainly founded on temperance, combined with the cultivation of active and regular habits as to exercise. Many amusing stories are told having this moral, and showing how gout has been cured by the opportune occurrence of calamities which have created the necessity for labor, and removed the means of self-indulgence. With a few special exceptions, indeed, it may be said that the laboring class, and especially those that labor in the open air, are almost if not altogether free from this disease. Those, again, that labor much with the mind, not being subject either to great privations, or to the restraint of unusually abstemious habits of life, are remarkably subject to gout; the more so if their bodily and mental constitution has been originally robust, and fitted by nature for a degree of activity which the artificial necessities of fashion or of occupation have kept within too narrow limits. Hence, the well-known saying of Sydenham, that gout is almost the only disease of which it can be said that it "destroys more rich men than poor, more wise men than simple." And in this manner, accordingly (he adds), there have lived and died "great kings, princes, generals, admirals, philosophers, and others like these not a few." Gout is, therefore, the counterpoise in the scales of fortune to many worldly advantages; the poor and needy have it not, but suffer from their own peculiar calamities; the favorites of fortune are exempt from many privations, but this very exemption paves the way for the gout; whereby even in this world Dives suffers as well as Lazarus, and sometimes, it may be, learns the lesson of his suffering. Such is the sense, though not the exact words, in which, nearly two hundred years ago, Sydenham expressed the convictions of a lifetime on this subject.

Sydenham's treatise on gout is interesting not only as containing the well-considered views of a master in the medical art, but also as the faithful description of the disease by one of the victims of it. His account of the paroxysm of regular gout may be given here with some abbreviation. After some weeks of previous indigestion, attended with flatulent swelling and a feeling of weight, rising to a climax in spasms of the thighs, the patient goes to bed free from pain, and having had rather an unnaturally strong appetite the day before. In the middle of the night, he is awakened by a pain in the great toe, or sometimes in the heel, the ankle, or the calf of the leg. The pain resembles that of a dislocated bone, and is accompanied by a sense as if water not perfectly cold were poured over the affected limb; to this succeeds chilliness, with shivering, and a trace of feverishness, these last symptoms diminishing as the pain increases. From hour to hour, until the next evening, the patient suffers every variety of torture in every separate joint of the affected limb; the pain being of a tearing, or crushing, or gnawing character, the tenderness such that even the weight of the bed-clothes, or the shaking of the room from a person's walking about in it, is unbearable. The next night is one of tossing and turning, the uneasy limb being constantly moved about to find a better position; till towards morning the victim feels sudden relief, and falls over into a sleep, from which he wakes refreshed, to find the limb swollen; the venous distention usually present in the early stage having been succeeded by a more general form of swelling, often with itching between the toes, and a peeling-off of the cuticle. This individual attack may be repeated many times, in the course of what is termed "a fit of the gout," which commonly extends over a period of weeks, or even months, before the patient is completely relieved; or the attacks may occur in both limbs, or in several other parts of the body in succession, the real termination of the "fit" being at last indicated by an apparently complete restoration of health, and even, in some cases, by a period of improved condition and capacity for exertion, as compared with the state of the patient before the attack.

Such are the principal features of the "regular gout." In this form, it might almost be called a local disease; although the connection of the attacks with deranged digestion, or with a variety of other minor ailments too complex to be described here, and the obvious relief obtained through the "fit" from the symptoms of constitutional suffering, point to a cause of the disease operating over a larger range of functions than those included in the ordinary local manifestations at this period. Regular gout, accordingly, forms only part of a nosological picture, in which the so-called irregular, atonic, metastatic, or retrocedent forms have to be included before it can be said to be at all complete. These, indeed, form almost all the darker shadows of the picture; for regular gout, though a very painful disorder, can hardly be said to be dangerous to life, or even to the limb affected, at least until after many attacks.

It is the tendency, however, of gout, when recurring often, to fall into irregular forms, and herein lies its danger. One source of local aggravation is, indeed, soon apparent, and it leads rapidly to other evils. The joints which have been repeatedly the seat of the regular paroxysm, become, more or less permanently, crippled and distorted. A white, friable, chalk-like material is gradually deposited around the cartilages and ligaments, and sometimes in the cellular tissue and under the skin. Sometimes this material is discharged externally by ulceration, and then usually with relief. At other times, it accumulates into irregular masses, or "nodosities," which entirely destroy, or at least greatly impair, the movement of the limb. The patient is laid up more or less permanently in his arm-chair; and exercise, the great natural specific remedy of the gouty, is denied by the very conditions of the diseased state itself.

Then follow aggravations of all the constitutional sufferings; the more so, perhaps, in proportion as the local attacks in the foot become obscurely marked. Indigestion continues, or becomes constant, assuming the form chiefly of acidity after meals; the liver becomes tumid, the abdomen corpulent, the bowels disposed to costiveness; the kidney discharges a vitiated secretion, and not unfrequently there is a tendency to gravel and calculus (q.v.); the heart is affected with palpitations, or fainting-fits occur, sometimes with spasmodic attacks of pain; the arteries become the seat of calcareous deposits, and the veins are varicose in the limbs and in the neighborhood of the lower bowel (see PILES); the temper is singularly irritable, and often morose; then, sooner or later, the appetite fails, or is only kept up by very stimulating and unwholesome diet, with an excess of wine or of alcoholic liquors; in the end, the body emaciates, the energy of all the functions becomes enfeebled, and the patient falls a prey to diarrhea, or to some slight attack of incidental disease. Sometimes the end is sudden, as by apoplexy or structural disease of the heart; sometimes, on the other hand, it occurs in the midst of one of those violent spasms which have popularly acquired the name of "gout in the stomach;" the true character of these attacks, however, being by no means well understood.

The sketch here given of the leading external phenomena of gout is very incomplete, as every popular description, to be at all intelligible, must necessarily be. But the reader will not fail to see in it the type of a disease occurring under a number of remarkably varied forms, and lurking in the constitution, at times, under the most strangely anomalous disguises, or even under the general aspect of robust or rude health. It has been an object, accordingly, with physicians to trace out the gouty predisposition under the name of a habit of body, or *diathesis*, cognizable previously to any of the local manifestations. At this point, however, the ideas of authorities usually become hazy, and their descriptions correspondingly ill defined or contradictory. The anomalous forms of the disease itself are also exceedingly difficult to describe accurately, and must on this account be left out of the present summary of the characters of the more usual aspects of gout, as it presents itself to physician and patient. The causes of the disease have been sufficiently indicated above.

One fact in regard to gout has relation to its intimate chemical and structural pathology, not less than to its outward characters; and forms, in fact, the pathological connection of a great number of its phenomena. The concretions found in the joints in all cases of well-marked and highly developed gout have nearly a uniform composition, into which the urate of soda (see URIC ACID) enters as a considerable proportion. Uric acid has long been known as one of the constant organic elements of the urine, through which it seems to be habitually expelled from the system. In certain circumstances, uric acid is deposited also in the form of urinary gravel or calculus (q.v.); and it is this particular kind of gravel to which the gouty are especially subject, as we have indicated above. A conjunction of facts so striking as these could not but arrest the attention of pathologists; and it is long since sir Henry Holland and others threw out the hypothesis, that uric acid was to be regarded as the very *materies morbi* of gout, of which ancients and moderns had been so long in search. It would be out of place to enter on the discussion of this subject here; but it must be indicated as a fact of recent discovery, that uric acid in a certain excess has been shown by Dr. Garrod to be characteristic of the blood of the gouty, although a minute amount of this substance is probably present even in perfect health. The most recent speculations, accordingly, tend to connect the gouty predisposition either with an excessive formation, or a checked excretion, of this important nitrogenous organic acid, the product, as physiology teaches, of the vital disintegration of the flesh and of the food, after these have subserved the daily wants of the system. At this point, the inquiry rests for the present.

The *cure* of gout, in the highest sense of the word, demands the careful consideration of all its predisposing causes in the individual, and the strict regulation of the whole life and habits accordingly, from the earliest possible period. It is the difficulty of accomplishing this which makes gout a disease proverbially intractable; for the regular attacks of the disease seldom occur till pretty late in life, long after the habits have been fully formed which are most adverse to the cure. Rigid temperance in eating and drinking, with daily exercise proportionate to the strength and condition of the individual, in reality constitute the only radical cure of gout, the lesson of ages of experience as read to the gouty by the light of science. But the lesson is not learned, or only learned when too late. It should never be forgotten that a man of gouty family, or individually much exposed to the causes of the disease, can only hope to escape it in his old age by habits of life formed at an early period, and by a careful avoidance of most of the common dissipations of youth. That the disease may be warded off in this way, there is ample evidence, and it is not less certain that there is no other way of living secure from gout. The treatment of the fit, in so far as it does not resolve itself into the celebrated prescription of "patience and flannel," must be a subject of medical prescription. The well-known virtues of colchicum (q.v.) are perhaps somewhat overrated by the public; and its dangers are not less striking than its virtues. It is certain, however, that in cautious medical hands colchicum is a remedy of great value in the gouty paroxysm; and of equal value perhaps are certain natural mineral waters, as those of Vichy and Carlsbad. Alkalies and their salts, especially potash and

lithia waters, as prepared artificially, with minute doses of iodine and bromine, have likewise been much recommended for the cure of gouty deposits. For the distinctions of gout and rheumatism, and the presumed relation between them in some cases, see RHEUMATISM.

GOUT-WEED, or BISHOP-WEED (*aegopodium podagraria*), a perennial umbelliferous plant, with coarse twice ternate leaves, ovate unequally serrate leaflets, stems from 1 to 3 ft. high, and compound umbels; now a very common weed in gardens and waste grounds in Britain, although believed to have been originally introduced by the monks from the continent of Europe, on account of the virtue ascribed to it of allaying the pain of gout and piles. It is a troublesome weed, very difficult of eradication. Its medicinal virtue is now discredited. Its smell is not agreeable, but its young leaves are used in Sweden in early spring as a pot-herb. Another English name is herb gerard.

GOVAN, a thriving and picturesque burgh of Scotland, in the co. of Lanark, is pleasantly situated 2 m. w. of Glasgow, with which it is connected by an elegant line of villas, on the left bank of the Clyde. The prosperity of Govan is chiefly dependent upon Glasgow, into which indeed it has become almost absorbed. It now contains several ship-building yards, which are carried on by Glasgow firms. There are also at Govan a dye-work and a factory for throwing silk. Pop. '71, 19,200. In the 16th c., this ancient village was considered one of the largest in Scotland, and even down to the middle of the 17th c., it received the name of "Meikle Govane."

GOVE, a co. in w. Kansas, on Smoky Hill river and the Kansas Pacific railroad; 900 sq.m.; formed after the census of 1870.

GOVERNMENT, in its political signification, may be considered as including the power by which communities are ruled, and the means by which, and the form and manner in which, this power is exercised. In treating of the subject, we shall first indicate those characteristics that seem essential to the existence of government altogether, and then proceed to mention the various forms which its machinery has assumed, or is capable of assuming.

1. It is of the essence of every government that it shall represent the supreme power or sovereignty of the state, and that it shall thus be capable of subjecting every other will in the community, whether it be that of an individual, or of a body of individuals, to its own. There is and can be no constitutional or fundamental law, not self-imposed, which is binding on a government in this, its highest sense. Whatever be the restraints which humanity, Christianity, or prudence may impose upon governments as on individuals, it is implied in the idea of a government that it should be politically responsible to no human power, at least for its internal arrangements, or, in the language of politics, that it should be autonomous. The government of states which are members of a confederation—as, for example, the states of the American republic, or the Swiss cantons—do not, it is true, possess this independent character. But in so far as they fall short of it, they are deficient in the characteristics of a government in the absolute sense, just as the states are states, not in the highest, but only in a subsidiary sense. The sovereign power with which government is thus armed may be an expression either of the general will of the community itself, as in free states, or of the will of a conqueror, and of the army which supports him, as in subject states. In the former case, the power of government over the individual citizen is as absolute as in the latter; but there is this very important difference between them, that in the former case he himself voluntarily contributes a portion of the absolute power to which he submits, whereas in the latter it is entirely independent of his volition. In the power which government possesses of controlling every other will, is implied the power of protecting every separate will from being needlessly or wrongfully controlled by any other will, or number of wills, the will of the government always excepted. With a view to the exercise of this latter power, government possesses a right, which politically is also unlimited—the right, namely, of inquiry into the relations between citizen and citizen. It is of its essence that its scrutiny should be as irresistible as the execution of its decrees. 2. Every government, whatever be its form, seeks the realization of what we have described as its necessary character, by the exercise of three distinct functions, which are known as its legislative, judicial, and executive functions. The first, or legislative, function of government, consists in expressing its sovereign will with reference to a particular matter, irrespective altogether of the effect which it may have on the interests of individuals; the second, or judicial, consists in applying the general rule, thus enunciated, to individual cases in which disputes as to its application have arisen; whilst the third, or executive function, consists in carrying into effect the determinations of the sovereign will, whether these determinations be expressed in the exercise of its legislative or its judicial functions.

In large communities, which are at the same time free—that is to say, in which the general will of the people is sovereign—the performance of the legislative functions of government almost necessarily implies the existence of a general council, parliament, or, as it is often called, a legislature; whilst the performance of its judicial functions implies the existence of judges and courts of justice, and of its executive that of a police and an army. But all of these, like the existence of councils of ministers, or

servants of the sovereign will—governments in the narrower sense—and the rules by which their appointment, resignation, etc., are regulated, are practical necessities of government in certain circumstances, not theoretical necessities of government in the abstract.

The forms in which communities have sought to realize the idea of government, as thus explained, have been divided, from very early times, into three classes: 1st, monarchy, or that form in which the sovereignty of the state is placed in the hands of a single individual; 2, aristocracy, or that in which it is confided to a select class, supposed to be possessed of peculiar aptitude for its exercise; and, 3d, democracy, or that in which it is retained by the community itself, and exercised either directly, as in the small republics of ancient Greece, or indirectly, by means of representative institutions, as in the constitutional states of modern times. Each of these forms of political organization, if called into existence by an expression of the general will of the community, maintained by its consent, and employed for its benefit, is said to be a legitimate government (Aristot. *Politic.* lib. iii. c. 5)—that is to say, a government which vindicates the interests of the collective body of the people without needlessly encroaching on individual freedom of action. But each of these legitimate forms was said by the ancient publicists (Aristot. *ut sup.* and iii. 4, 7) to have a particular degenerate form to which it was prone. Monarchy tended in the direction of tyranny, or a government for the exclusive benefit of the single ruler; aristocracy to oligarchy, or a government for the exclusive benefit of the ruling class; and democracy to ochlocracy, or mob-government —a government in which the majority, who were necessarily the rudest and most ignorant portion of the community, exercised a tyranny over the more refined and cultivated few. Through these various forms, in the order in which we have enumerated them, each legitimate form being followed by its corresponding degenerate or perverted form, government was supposed to run in a perpetual cycle; the last form, ochlocracy, being followed by anarchy, or no government at all, which formed a species of interregnum so abhorrent to the social and political instincts of mankind as to induce them speedily to revert to monarchy, at the expense of subjecting themselves to a repetition of the misfortunes which they had already experienced. As a refuge from these evils, the so-called mixed government, or government which should combine the elements of order and permanence of two, at least, if not of all the three pure forms of government, whilst rejecting their tendencies to derangement and degeneracy, is supposed to have been devised. A union of aristocracy and democracy was the form in which Aristotle conceived the mixed government, and spoke of it under the title of the *politeia.* But the tripartite government was not unknown to speculators of even an earlier date. Plato had shadowed it forth in his laws, and Aristotle himself tells us that it had been treated of by other writers (*Politic.* ii. c. 3). Who these writers really were has been a subject of much speculation, but there is reason to believe that their works contained mere hints of the principle, and the first writer with whom we are acquainted to whose mind its practical importance was fully present is Polybius, who, with Cicero, by whom he was very closely followed in "the republic," holds it to have been realized in the Roman constitution. The most famous example of the mixed government, however, is supposed to be exhibited in that balance of powers which has been so often said to form the essence of the English constitution. But in addition to the fact that these are not separate powers, but only separate organs of the one power or sovereignty which in free states is of necessity centered in the general will (see CONSTITUTION), it is extremely doubtful whether any period could be pointed out, either in our own history or in the history of any other nation, in which the sovereignty did not find expression obviously either through the one, the few, or the many; or whether such a period, if it did exist, was not a mere period of struggle and transition.

The question as to how far forms of government are a matter of choice on the part of a free people, or are dictated to them by influences which are beyond their volition, has been discussed in a very interesting manner by Mr. Mill in his important work on *Representative Government.* The conclusion at which he arrives is, that "men did not wake on a summer morning and find them sprung up; neither do they resemble trees," which, once planted, "are aye growing" while men "are sleeping;" but that "in every stage of their existence they are made what they are by human voluntary agency" (p. 4). This absolute power of human choice, however, is limited by three conditions which Mr. Mill states thus: "The people for whom the government is intended must be willing to accept it, or at least not so unwilling as to oppose an insurmountable obstacle to its establishment; they must be willing and able to do what is necessary to keep it standing; and they must be willing and able to do what it requires of them to enable it to fulfill its purposes. . . . The failure of any of these conditions renders a form of government, whatever favorable promise it may otherwise hold out, unsuitable to the particular case" (p. 5). But there are still more important conditions, not here enumerated by Mr. Mill, but one of which at least is fully recognized in the sequel of his work, which, if not complied with, render forms of government unsuitable not only to one case, or stage of social development, but to all cases and all stages of development. These conditions may be broadly stated as falling under a single category—viz., that forms of government must conform to the constitution of human nature, and recognize those arrangements of Providence which are beyond the reach of human control.

This condition seems so obvious, that one would suppose it could scarcely be overlooked in fixing on a particular form of government, and yet there is none which has been overlooked more frequently. The most prominent example—to which, in recent years, much importance has been attached by Mr. J. S. Mill and all speculative politicians of note—is that in which a form of government is constructed on the assumption that "all men are equal," the fact of nature being the very opposite. Such a form of government, being founded on a false assumption, can be made to work only by the direct results of its action being counteracted by indirect means, as has been the case in all the so-called pure democracies that have had any permanent existence. The state in these cases is governed not in accordance with, but in spite of the form of government.

The famous discussion as to what is absolutely and in itself the best form of government, which has occupied so large a portion of human time and ingenuity, is one which we must here dismiss with the observation, that it rests on another question which has been not less keenly and perhaps scarcely less futilely discussed. The second question is, What is the end of government? for it is clear that could the end-in-itself (the *telos teleion*) be discovered, we might limit the discussion as to the best form of government to an inquiry into the means which led most directly to the attainment of this end. Now there are, and have always been, two classes of speculators, who assign what appear to be different, and what by many are believed to be irreconcilable ends or objects to government, and indeed to human effort, separate as well as aggregate. By the one, the end of government is said to be "the greatest happiness of the greatest number," or the greatest amount of human happiness absolutely considered; by the other class it is said to be the realization of the idea of humanity—that is to say, of the divine conception of human nature, through the instrumentality of society. The manner in which the first or utilitarian creed has recently been expounded by its most important adherents, has had the effect of showing that the two ends are in reality coincident. If happiness be so defined as to render it identical with moral, intellectual, and physical perfection, the advocate of the ideal end acknowledges that its attainment would involve, of necessity, the realization of his own aspirations.

A difference of opinion as to the objects of government scarcely more real, though attended with far more fatal consequences than that which has divided speculative politicians, has ranged those who have dealt with government as a practical art in two opposite schools. By the one school, its object is said to be order; by the other, liberty; and each of these objects has been supposed to be attainable only to an extent proportioned to that to which the other was sacrificed. A truer insight into the laws of society has led a more enlightened school than either entirely to reverse this latter opinion; and—whilst holding the two objects referred to, to be in truth the proximate objects of all government—to perceive that they are not only reconcilable, but that each is attainable only in and through the other, and that the perfection with which either is realized in any particular instance will be not in inverse but in direct proportion to that to which the other is so. Order, so far from being the opposite of liberty, is thus the principle by which conflicting claims to liberty are reconciled. The principle which is really opposed to liberty is license, in virtue of which the sphere of the liberty of one individual is endeavored to be carried into that of another. To the extent to which this takes place, the liberty of both is sacrificed, for the territory in dispute is free to neither of the claimants; whereas order, by preserving the boundary between them, assigns to each the portion which is his due, and prevents the waste of liberty which is necessarily involved in the gratification of license, and the consequent existence of anarchy. The reasons which have led men to believe that the union between the principles of order and liberty, which it is thus their mutual interest to effect, can, in large states, be effected by means of representative institutions better than by any other political expedient that has yet been devised, will be explained under REPRESENTATIVE GOVERNMENT. See also CONSTITUTION, MONARCHY, DEMOCRACY, LIBERTY, EQUALITY, and FRATERNITY.

GOVERNMENT, COST OF. The *per capita* annual cost of general and local government was estimated before the American war of the rebellion, to be, in the United States, general, 97 cts.; state, 50 cts.; city or town, 92 cts.; in all, $2.39. In England it was stated at $12.33; in France, $7.50.

GOVERNMENT'S ISLAND. See ROCK ISLAND.

GOVERNOR, in mechanics, a piece of mechanism to govern the speed of a machine or engine. It is usually applied to steam engines. The ordinary method is to make use of centrifugal force, by which two suspended metallic balls, by their rise and fall, increase or decrease the admission of steam to the cylinder. See STEAM ENGINE.

GOVERNOR'S ISLAND, in Boston harbor, occupied entirely by the national government for purposes of defense. The principal fortification is fort Winthrop.

GOVERNOR'S ISLAND, in the bay of New York, near to the lower point of the city. It is one of the islands occupied entirely by the general government for military and naval purposes. The forts are Columbus, castle William, and the south battery. There are some fine buildings for the principal officers, and the island is usually the

head-quarters of the military division of the Atlantic. The ordnance department has a depot there.

GOVINDA, SINGH, b. 1661, at Patna, Behar; a teacher and reformer of the Sikh sect. After spending twenty-five years in the mountains in the study of the Koran and Hindu religious works, he proclaimed himself a special messenger from God. He was opposed to caste, the worship of saints and images, and taught the divine unity. He made many converts to the sect of the Sikhs. Abandoned by his allies when at war with the Mongols, and his stronghold Tchaukor having been taken, he fled, disguised as a dervis, to the desert of Bhutinda, where he was reinforced by many of his friends. He was afterwards made governor of a province by the emperor Bahadur Shah, but soon died. He wrote several religious works.

GOWER, or GWYR, a peninsula in s. Wales, projected 15 m. into the British channel, and forming the extreme w. portion of Glamorganshire. It is about 5 m. wide. In the time of Henry I., a colony of Flemings settled on this peninsula, and their descendants still retain many of the ancient characteristics. They rarely intermarry with the Welsh.

GOWER, JOHN, the date of whose birth is unknown (probably about 1320), is supposed, by his latest biographer, to have belonged to the county of Kent. His history is enveloped in almost total obscurity, but he seems to have been one of the most accomplished gentlemen of his time, and to have been in possession of considerable landed property. He was a personal friend of Chaucer's, who addresses him as "a moral Gower" in dedicating to him his *Troilus and Cressida*—an epithet which has indissolubly linked itself to his name. He did not long survive his great contemporary, having died in the autumn of 1408. Gower was a voluminous writer, and produced the *Speculum Meditantis* (a poetical discourse on the duties of married life). It consisted of ten books, written in French verse, but is supposed to have perished; the *Vox Clamantis*, in Latin (of which there are manuscript copies in the Cottonian and Bodleian libraries); and the *Confessio Amantis*, by which he is best known, in English. This latter work, extending to the portentous length of 30,000 verses, was first printed by Berthelet in 1573. An excellent edition of the works of Gower was published in 1857, under the editorial care of Dr. Reinhold Pauli, with a memoir and critical dissertation.

Gower is almost uniformly heavy and prosaic. Writing much in French, his English poem is full of Norman-French words, and in his native tongue he never attained Chaucer's ease and mastery. Apart from literary merit or demerit, his poem is interesting to the scholar and the antiquary, because therein the elements which form our modern English are found side by side, or but indifferently fused together.

GOWRIE, CARSE OF. See PERTHSHIRE and CARSE

GOWRIE CONSPIRACY, one of the most singular events in the history of Scotland, took place in Aug. 1600. On the 5th of that month, as king James VI., then residing at Falkland palace, in Fife, was going out to hunt, Alexander Ruthven, brother of the earl of Gowrie, whose father had been executed for treason in 1584, came to his majesty, and informed him that, on the previous evening, he had seized a person of a suspicious appearance, and evidently disguised, with a pot full of foreign gold hid under his cloak, and had confined him in his brother's house at Perth. Conceiving him to be an agent of the pope or the king of Spain, the king agreed to examine the man himself, and without waiting to change his horse, set out for Perth, attended only by the duke of Lennox, the earl of Mar, and about 20 others. Soon after his arrival, while his retinue were at dinner, Ruthven conducted the king up a winding staircase and through several apartments, the doors of which he locked behind him, and brought him at last to a small study, where stood a man in armor, with a sword and dagger by his side. Snatching the dagger from the man's girdle, Ruthven held it to the king's breast, and said: "Who murdered my father? Is not thy conscience burdened by his innocent blood? Thou art now my prisoner, and must be content to follow our will, and to be used as we list. Seek not to escape; utter but a cry, make but a motion to open the window, and this dagger is in thy heart." The king expostulated with Ruthven, who so far relented that he went to consult his brother, leaving the king in charge of the man in armor. In the meantime, one of Gowrie's servants hastily entered the apartment where the king's retinue were, and announced that the king had just ridden off towards Falkland. All hurried into the street, and the earl, with the utmost eagerness, called for their horses. On Alexander Ruthven's return to the king, he declared that there was now no remedy, but that he must die, and proceeded to bind his hands with a garter. The king grappled with him, and a fierce struggle ensued. Dragging Ruthven towards a window looking into the street, which the man in armor had opened, the king cried aloud for help. His attendants knew his voice, and hastened to his assistance. Lennox and Mar, with the greater number of the royal train, ran up the principal staircase, but found all the doors shut. Sir John Ramsay, of the Dalhousie family, one of the royal pages, ascending by a back stair, entered the study, the door of which was open, and seizing Ruthven, stabbed him twice with his dagger, and thrust him down the stair, where he was killed by sir Thomas Erskine and sir Hugh Herries. On the death of his brother, Gowrie rushed into the room, with a drawn sword in each hand, followed by seven

retainers, well armed, and was instantly attacked. Pierced through the heart by sir John Ramsay, he fell dead without uttering a word. The inhabitants of Perth, by whom Gowrie, who was their provost, was much beloved, hearing of his fate, ran to arms, and, surrounding the house, threatened revenge. The king addressed them from a window, and admitted the magistrates, to whom he fully related all the circumstances, on which they dispersed, and he returned to Falkland. Three of the earl's servants were executed at Perth. The man in armor, Andrew Henderson, the earl's steward, was pardoned. All who were examined were totally ignorant of the motives which prompted the brothers Ruthven to such a deed, and they still remain in some degree of mystery, although recent discoveries have led to a pretty general belief that the object of the conspirators was to possess themselves of the king's person, to convey him by water to Fast castle, and either to give him up to England, or to administer the government in his name in the interest of that country and of the Presbyterian leaders at home. Most of the documents relating to the plot are printed.

GOYA, a city in the Argentine confederation, 100 m. s. of Corrientes; pop. about 20,000, of whom 90 per cent are said to be unable to read. The place is on low ground; cattle raising is the main business.

GOYANNA, a city of Brazil, in the province of Pernambuco, is situated on a river of the same name, 35 m. n.w. of Olinda. It has numerous factories and an active trade. Pop. upwards of 10,000.

GOYA Y LUCIENTES, FRANCISCO, the most distinguished painter of the new Spanish school, was b. at Fuente de Todos, in Aragon, Mar. 31, 1746, and received his first education in art in the academy at San Luis, Saragossa. On his return from a visit to Rome, the talent and speed with which he executed some paintings for the royal tapestry manufactory gained the approbation of the celebrated Mengs, who superintended that work. His scenes from the common life of the Spanish people excited special admiration; but all the productions of his easel during this early period, to which belong the altar-piece and the crucifix at the entrance to the choir of the church of San Francisco al Grande in Madrid, are marked by simplicity of composition, charming truthfulness, and a natural and effective chiar-oscuro. In 1780 he was elected member of the academy of San Fernando. From this time, the influence of Velasquez and Rembrandt is observable in his paintings. Among the most celebrated of these is his portrait of Charles IV., for which he was made court-painter. In general, his portraits were executed with great facility and ease. In 1824, he went to Paris for his health, and continued to reside in France till his death, which took place at Bordeaux, April 16, 1828. Besides his works in oil-color, Goya is celebrated for his essays in fresco-painting, etching, lithography, and in almost every department of his art.

GOYA'Z, a city of Brazil, is situated on the river Vermelho, in lat. 16° 21′ s., long. 50° 35′ w., nearly in the middle of the empire, being the capital of the central province, which bears its name. The city contains about 8,500 inhabitants; and the province, with an area of 290,000 sq.m., has, according to the government estimates in 1872, a population of only 180,000 (besides 15,000 Indians), mostly aborigines. The chief productions are cotton, timber, and cattle.

GO'ZO, or Gozzo (called by the Romans *Gaulos*), an island in the Mediterranean, belonging to Britain, is about 10 m. in length, and about 5 m. in breadth; has an area of 36 sq.m., and a pop. of 17,000. Its surface is agreeably diversified, and it has many fertile valleys. It appears to have been formerly connected with Malta, from which it is now separated by a channel 4 m. in width. On this account, and from its natural productions, it is a spot of the highest interest to the naturalist, while the cyclopean walls of the "Giant's Tower" and Roman monuments of a later period excite the attention of the antiquary. The island abounds in game, and is much frequented by sportsmen. It produces large quantities of grain and cotton, and is celebrated for cattle and for a breed of large asses. From the circumstance of its having two harbors, it is likewise of importance in a commercial and nautical point of view. The chief town is Rabato, situated near the center of the island. The British governor resides in the Castel del Gozzo.

GOZZI, CARLO, 1722–1806; a native of Venice, and brother of the author Gaspard, but of stronger intellectual ability. Before he was sixteen he had written four poems of great length, and many smaller pieces. In 1761, his comedy of *The Three Oranges* had an unprecedented run. Similar pieces followed, until he fairly rivaled the famous Goldoni. Still he was far more popular abroad than at home. A complete edition of his plays was published in 12 vols. (Venice, 1791).

GOZZOLI, BENOZZI, a famous fresco-painter, was b. at Florence about the beginning of the 15th c., and studied under Fra Angelico, whose excellence as a painter of sacred subjects he fully equaled, if not surpassed. A glow of rejoicing life seems infused into all Gozzoli's productions. His chief works bearing traces of his master's influence are frescos in the churches of Orvieto and Rome; his own style being visible in the paintings he executed by command of Pietro de' Medici, in a chapel of the Medici, now Riccordi palace, at Florence. The great work, however, on which Gozzoli's fame rests, is the immense frescos executed on the n. wall of the famous cemetery, or Campo

Santo of Pisa. This wonderful series of paintings, not inaptly termed by Vasari *una terribilissima opera* ("a terrific work"), was undertaken by the artist at the age of sixty, and accomplished in 16 years. The scenes, which are all scriptural, are 24 in number, and are still in excellent preservation. Gozzoli died in 1485.

GRAAF, REGNIER DE, a celebrated Dutch physician, was b. at Schoonhove in 1641, and d. at Delft in 1673. He studied at the university of Leyden under Dubois (De le Boé), who is better known under his Latinized name of Sylvius; and on the death of the latter, in 1672, would have been unanimously elected to the vacant chair, if his religion (he was a Catholic) had not proved an insuperable obstacle to his appointment. In 1664, when only twenty-three years of age, he published his *Disputatio Medica de Natura et Usu Succi Pancreatici*, which, although containing several errors—as for instance, that the pancreatic juice is acid, and that many diseases, and especially intermittent fevers, are due to a morbid condition of this fluid—gained him a great reputation. After a short residence in France, where he took his doctor's degree at Angers in 1665, he returned to Holland, and settled at Delft, where his success in practice gained him much envy. He rendered great service to anatomy in being the inventor of those injections of the blood-vessels which Swammerdam and Ruysch brought to a state of comparative excellence, and which are at the present day the basis of our sound knowledge of most of the tissues of the body. He published several dissertations on the organs of generation in both sexes, which involved him in a prolonged and angry controversy with Swammerdam. According to Haller, his death was occasioned by an attack of jaundice, brought on by the excitement of this controversy, but we do not know Haller's authority for this assertion. All his works were published in one octavo volume, entitled *Opera Omnia*, in 1677, and republished in 1678 and 1705.

GRAAFIAN VESICLES. See OVARY.

GRAAL, GRAL, GRAIL, or GRÉAL (derived probably from the old French, perhaps Celtic, *gréal*, Provençal, *grazal*, mediæval Latin, *gradalus*), signifies a kind of dish. In the legends and poetry of the middle ages, we find accounts of the holy graal—San Gréal—a miraculous chalice, made of a single precious stone, sometimes said to be an emerald, which possessed the power of preserving chastity, prolonging life, and other wonderful properties. This chalice was believed to have been the first brought from heaven by angels, and was the one from which Christ drank at the last supper. It was preserved by Joseph of Arimathea, and in it were caught the last drops of the blood of Christ as he was taken from the cross. This holy chalice, thus trebly sanctified, was guarded by angels, and then by the templises, a society of knights, chosen for their chastity and devotion, who watched over it in a temple-like castle on the inaccessible mountain Montsalvage. The legend, as it grew, appears to have combined Arabian, Jewish, and Christian elements, and it became the favorite subject of the poets and romancers of the middle ages. The eight centuries of warfare between the Christians and Moors in Spain, and the foundation of the order of knight templars, aided in its development. The stories and poems of Arthur and the round table were connected with this legend. About 1170 Chrétien of Troyes, and after him other troubadors, sang of the search for the holy graal by the knights of the round table, in which they met with many extraordinary adventures. Some have supposed that the story of the connection of the miraculous chalice with the last supper and the blood of Christ arose from a wrong division of the words *san gréal*, holy vessel, which were written *sang réal*, royal blood, blood of the Lord; but although the coincidence is curious, there is no good reason to suppose that a pun could have been the foundation of a superstition which spread over Europe. The legend of the graal was introduced into German poetry in the 13th c. by Wolfram von Eschenbach, who took Guiot's tales of Parcival and Titurel as the foundation of his poem, but filled it with deep allegorical meanings. Tennyson's *Holy Grail* has recently made the legend familiar to English readers. Much information on the subject may be found in Lang's *Die Sage vom heiligen Graal* (1862), Cassel's *Der Graa u. sein Name* (1865), Droysen's *Dev Tempel des h. Graal* (1872), and Zarncke's *Der Gral-tempel* (1876).

GRABS, vessels of from 150 to 300 tons, employed on the Malabar coast. They are broad armed ships, with two or three masts, and unsuited for very heavy weather.

GRAC'CHUS is the name of a Roman family, of the gens Sempronia, which contributed several famous citizens to the state. First we have Tiberius Sempronius, who was consul in 238 B.C., and conducted some warlike operations in Corsica and Sardinia. Another Tib. Sempronius distinguished himself in the second Punic war, and for his success in opposing Hannibal, was honored with the consulship in 215 B.C., and again in 213 B.C. In those days of despondency, he did much to revive the spirit of the senate and people; with the allies, and 8,000 *volones*, or volunteer slaves (who afterwards gained their liberty as a reward for their bravery), he withstood the Carthaginians in south Italy, defeated Hanno, and checkmated Hannibal himself; but after many victories, he at length lost his life, either in battle with Mago, or, according to others, by treachery. Hannibal honored him with a splendid funeral. Passing by some Gracchi of minor note, as the augur of 203 B.C., the tribune of 189 B.C., and others, we come to Tiberius Sempronius, the father of those two reformers and friends of the people whose

fame has overshadowed all the others. He was born about 210 B.C., and for many years occupied a foremost position in the state. He was successively tribune, ædile, prætor, consul (twice), and censor, and distinguished himself in several wars. He introduced some important constitutional changes, and was often employed on foreign embassies, in which his judgment and concilatory spirit were of great service to the state. He married Cornelia, the youngest daughter of P. Scipio Africanus, by whom he had twelve children. Nine of these died in youth; a daughter, Cornelia, married Scipio Africanus the younger. The history of his two sons follows:

I. TIBERIUS SEMPRONIUS GRACCHUS was b. about 168 B.C., and was educated with great care by his excellent mother (his father having died while he was yet very young). He first saw military service under his brother-in-law, Scipio Africanus the younger, whom he accompanied to Africa. He was present at the capture of Carthage, and is said to have been the first of the Romans to scale the walls. In 137 B.C., he acted as quæstor to the army of the consul Mancinus in Spain, where the remembrance of his father's good faith and clemency was so fresh, after forty years' interval, that the Numantines would treat with no other Roman but the son of their former benefactor. He was thus enabled to save from utter destruction an army of 20,000 Romans, who had been defeated, and were at the mercy of the Numantines. But the peace was considered by the aristocratic party at Rome as disgraceful to the national honor, and was repudiated, Mancinus being stripped naked, and sent back to the Numantines, that the treaty might thus be rendered void. Disgust and disappointment at this result are said by some, though without good reason, to have determined Gracchus to espouse the cause of the people against the nobles; but a much more feasible ground for his conduct is to be found in the oppressed state of the commons at the time. Being elected tribune, he endeavored to reimpose the agrarian law of Licinius Stolo, and after violent opposition on the part of the aristocratic party, who had bribed his colleague M. Octavius Cæcina, he succeeded in passing a bill to that effect. (For a detailed account of the measure, see AGRARIAN LAW.) Tiberius Gracchus, his brother Caius, and his father-in-law Ap. Claudius, were appointed triumvirs to enforce its provisions. Meantime, Attalus, king of Pergamus, died, and bequeathed all his wealth to the Roman people. Gracchus therefore proposed that this should be divided among the poor, to enable them to procure agricultural implements, and to stock their newly acquired farms. It is said that he also intended to extend the franchise, and to receive Italian allies as Roman citizens. He also diminished the time which citizens were required to serve in the army. But fortune turned against the good tribune. He was accused of having violated the sacred character of the tribuneship by the deposition of Cæcina, and the fickle people in large numbers deserted their champion and benefactor. At the next election for the tribuneship, his enemies used all their efforts to oust him; and a violent scuffle having arisen between the opposing factions, Gracchus was slain, along with upwards of 300 others. His surviving friends were imprisoned, exiled, or put to death.

II. CAIUS SEMPRONIUS GRACCHUS, who was nine years younger than his brother, was possessed of much greater natural powers, and of more comprehensive views. His brother's death, which occurred while he was serving in Spain under Scipio Africanus, deterred him for some years from entering into public life; and the nobles seeing his great abilities, and fearing his influence with the people, endeavored to keep him as long as possible on foreign service in Sardinia and elsewhere. But at length he unexpectedly returned to Rome, being urged by his brother's shade, as was said, to enter on his great mission. Goaded by the persecution and groundless accusations of his enemies, he stood for the tribuneship, and was elected in 123 B.C. After bringing forward some measures to take vengeance on his brother's murderers, he set himself to carry out the agrarian law, which, though not repealed, had by the machinations of the nobles been kept in abeyance. The two great aims of his legislation—viz., to improve the condition of the poor, and to curtail the power of the senate and nobles—were now prosecuted with the utmost vigor, and with unflinching steadiness of purpose. To develop the resources of Italy, and at the same time to employ the poor, he made new roads throughout all parts of the country, repaired old ones, and erected milestones. By his zeal, and by his unwearied industry in personally carrying out his own measures, even to superintending the execution of the public works, and by his affability and kindly good nature, he gained the esteem and approbation of all men with whom he came in contact. With the equites and the poorer classes, he was in special favor. But he at length fell, as his brother had done, by the intrigues of the nobles. One of his colleagues, M. Livius Drusus, was bribed by the opposite faction, and soon succeeded in undermining the influence of Caius by far surpassing him in the liberality of his public measures, and by his benefits to the commons. Gracchus having stood for the tribuneship a third time, was rejected. Ultimately, by a series of moves, the history of which is too long for our space, violence was employed against Caius and his party—a fearful struggle took place in the streets of Rome, in which 3,000 men are said to have perished. Many others were imprisoned, and afterwards executed. Caius held aloof from the fight, but was at length compelled to seek safety in flight. He escaped to the grove of the furies with a single slave, who first slew his master, and then himself. The people saw, when too late, the folly of which they had been guilty in abandoning their best friend in the hour of need, and endeavored to atone for their crime by erecting

statues to the brothers Gracchus, by declaring sacred the spots where their blood had been shed, and by offering sacrifices to them as to deities. Caius left a son, whose after-fate is unknown.

GRACE is an expression frequently used in Scripture and in theological discussion. Its distinctive meaning is the idea of *free and unmerited* favor. According to Aristotle, this is the proper meaning of *charis* (Gr. grace), even when applied to man. It is a benefit springing out of the liberality and freeheartedness of the giver, and bestowed without any hope or expectation of reward. Applied to God in the New Testament and in theology, it denotes the free outcoming of his love to man; and when man, on the other hand, is said to be in a state of *grace*, it implies that he is in the enjoyment of this divine love and favor. St. Paul draws a sharp contrast (Rom. xi.) between *charis* and *erga* (Gr. works), as mutually excluding one another. "And if by grace, then is it no more of works; otherwise grace is no more grace. But if it be of works, then is it no more grace: otherwise work is no more work."

Theologians have distinguished grace into *common or general*, and *special or particular*. *Common* grace is supposed to denote the love which God has to all His creatures, and the light of nature and of conscience which they all enjoy. *Special* grace is the love which God has for His elect people, and by which he saves them from their sins. This *special* or *saving* grace is sometimes also divided in various ways, and spoken of as electing, justifying, sanctifying grace; also, in respect of man, as *imputed* or *inherent* grace—the grace, that is to say, of Christ's righteousness imputed or reckoned to the account of those that believe on Him, and the grace of holy and pious dispositions wrought in the heart by the spirit of God. Grace is also spoken of as *efficacious* and *irresistible*, and the relation in which the elect or believing people stand to God is represented as a *covenant of grace*, in contrast with the primitive relation which Adam bore to his Maker before the fall, which is called a *covenant of works*.

All these theological distinctions have arisen in the course of extended argument and discussion on divine truth. They are not to be found—at least in their more technical sense—in the New Testament. The *charis* of St. Paul is not a logical distinction, but a spiritual fact. It is the loving aspect of God towards the sinner—towards all sinners, whereby all who confess their sins have free access into His favor, and receive the "adoption of sons." The technical distinctions of theology, however, are not without their value when rightly apprehended and interpreted. They mark the course of past controversy—they give precision to theological thought—and when not allowed to deface the simpler proportions of divine truth, they may teach needful and important lessons.

GRACE, DAYS OF. See BILL.

GRACE AT MEAT, the ancient Greeks offered a portion of a dish of meat to their gods before partaking of it themselves. A brief invocation before meals is simply an imitation of the practice of the Savior.

GRACES, the goddesses of grace, favor, and gentleness, the sources of all grace and beauty, appear in Homer in indefinite numbers as the attendants of Cytherea (Venus), whom it is their office to bathe and anoint. Hesiod and most other poets mention three graces—Agalia, Thalia, and Euphrosyne, the daughters of Zeus and Eurynome. Their worship is said to have been first introduced into Greece at Orchomenos, in Bœotia, by Eteocles. The Lacedemonians and Athenians originally recognized only two graces, called, by the former, Phænna and Kleta; by the latter, Hegemone and Auxo. In the early ages, the graces were represented in elegant drapery; at a later period, slightly draped, or entirely nude. They appear holding each other by the hand, or locked in each other's embrace.

GRACES, or GRACE NOTES, in music are used by composers to develop and increase the effect of some special notes. They are often introduced merely for embellishment, and the term may be applied to trills, turns, beats or springing notes.

GRACIAS Á DIOS, Cape, so called by Columbus who in his fourth voyage found safety from a storm by weathering this point. It is the extreme e. point of Honduras, at the mouth of the river Segovia, about 15° n. and 83° w. There is a tolerable harbor near by.

GRACIO'SA, one of the Azores islands (q.v.), and the seventh of that group in population and importance.

GRACKLE, or GRAKLE; in America the name applied to several species of the genera, *scolecophagus* and *quiscalus*, though these are more commonly called in the United States and Canada "blackbirds," and some of them "boat-tails." They belong to the family *icteridæ*. The best known of these are the rusty grackle, *S. ferrugineus*, which pervades almost the whole of North America, and *Q. purpureus*, the purple grackle or crow-blackbird, of more limited range, for though abundant enough in most parts to the e. of the Rocky mountains, it seems not to appear on the Pacific side. There is also brewer's or the blue-headed grackle, *S. cyanocephalus*, which has a more western range, not occurring to the eastward of Kansas and Minnesota. A fourth species, *Q. major*, is also found to inhabit the Atlantic states as far as North Carolina. All these birds are of exceedingly omnivorous habit, and though undoubtedly destroying

large numbers of pernicious insects, are in many places held in bad repute from the mischief they do to the corn crops.

GRA'DIENT. A tortoise walking is said, in heraldry, to be gradient.

GRADIENT, a term used chiefly in connection with railways, to signify a departure of the line from a perfect level.

GRADIENTIA, a group of amphibians and allied reptiles placed in an order by Merrem in 1821, but first described and given the name by Laurenti in 1768. The general characteristics are, the having of four legs upon which they run, and do not hop like frogs, and also the retaining during adult life the tadpole-state tail. The group contains some of the animals which by modern naturalists are usually classed under the order amphibia (q.v.), which now comprises four orders: I. The *ophoimorpha* of Owen, *gymnophiona* of Huxley, the *apoda* of older naturalists, a small order of animals having the appearance of huge earth worms. II. URODELLA, *ichthyomorphia* of Owen; *saurobatrachia*, the order of tailed amphibians, which were embraced in Merrem's order of *gradientia*, and including among other animals the Mexican *axolotl*. III. AMOURA, the *batrachia* of Huxley, and *theriomorpha* of Owen, an order including frogs and toads, animals having no tails, and excluded, therefore, by Merrem from GRADIENTIA. IV. The extinct order LABYRINTHODONTIA, resembling *urodella*, but often of gigantic size, of which the *labyrinthodon*, or *cheirotherium*, is the most striking example. See ZOÖLOGY.

GRADUAL, in the liturgy of the Roman and other western churches, means that portion of the mass which intervenes between the epistle and gospel, and consists of a few verses of the Holy Scriptures, generally taken from the Psalms. It was originally called the "Responsum," or "Cantus Responsorius;" but, probably for the sake of distinguishing it from other portions of the service called by the same name, its present appellation has been substituted. The name "gradual" is derived from the place at which this response was chanted, and which was either the ambo, or chanting pulpit, which is approached by "steps" (*gradus*), or the "steps" themselves, whether of the ambo or of the altar. Originally, as we find from St. Augustine, the gradual response consisted of an entire psalm, and in the mass of the first Sunday of Lent the entire of the 91st (90th in the Vulgate) psalm is chanted. In the Ambrosian liturgy, the gradual is partly from the Old and partly from the New Testament. The gradual, in the Roman liturgy, is always followed by the "alleluia," except in penitential time, when a slow and mournful chant, called the "Tract," is substituted.

GRADUALE, the name given to the music of the above described portion of the Roman liturgy. It is performed during mass after the epistle is read. It is said to have been used from the earliest times to allow the officiating priest time, during its performance, to take his place on the steps of the reading-desk, or on the steps of the gospel side of the altar. The music is according to the character of the words, and may be either an aria, duet, or chorus. The composition must not be long, as the priest has little ceremony to go through during its performance. The best specimens of the graduale are Haydn's *Insanæ et Vanæ Curæ; Salve Regina;* or Mozart's *Misericordias Domini; Sancta Maria; De Profundis*, etc.

GRADUAL PSALMS, or "PSALMS OF THE STEPS," or "SONGS OF DEGREES," a name given both by the Hebrews and in the Christian service-books to the fifteen psalms, 120-134 (119-133 in the Vulgate). The origin of this name is uncertain. The rabbins trace it to a fabulous incident connected with the building of the second temple; others explain it as an allusion to the fifteen steps by which (Ezek. xl. 22-26) the temple was reached; others, again, regard these psalms as containing a prophetic allusion to the return from captivity, which, in the language of the Jews, was "a going up," the 134th psalm being the full outburst of exultation at the accomplishment of that great object of hope and longing. These psalms, in the Romish Church, form part of the office of each Wednesday during the Lent.

GRADUA'TION, the art of dividing mathematical, astronomical, and other instruments. The simplest problem in graduation is the dividing of a straight line, such as an ordinary scale or rule. This is commonly done by copying from a standard scale, for which purpose a dividing square and a suitable knife for cutting the divisions are used. The dividing square is a hard steel straight-edge, with a shoulder at right angles like a carpenter's square. This is made to slide along the standard scale, and halt at each required division, when a corresponding one is cut upon the rule, etc., by using the steel straight-edge as a guide to the knife. The *original graduation* of a straight line into equal divisions, as in making a first standard scale, etc., is performed either on the principle of *bisection* or *stepping*. In bisecting, the points of a beam-compass (see COMPASS) are adjusted to nearly half the length of the line to be divided; one point is then placed at one end of the line, and a faint arc struck towards the middle: this is repeated at the other end; the small distance between these arcs is then carefully bisected with the aid of a fine pointer and magnifier, which gives an accurate half of the line. The half thus obtained is again bisected in like manner, and these quarters bisected again, and so on until the required subdivision is attained. Stepping is performed with delicately pointed spring-dividers, which are set at once as nearly as possible to the

opening of the small division required; then the points are made to step on, leaving at each step a very fine dot; and when it is found that the last dot either falls short of or overpasses the end of the line, the opening is adjusted accordingly, until perfect accuracy is obtained. Thus, if a line were divided into a thousand parts, and each division were $\frac{1}{1000}$th too long or too short, the error would amount to a whole division at the end of a thousand steps. The method of bisection is practically the most accurate, and has been adopted by Graham, Bird, Ramsden, Troughton, and other eminent artists in original graduation. Curved lines are divided on this principle. The chord of an arc of 60° is equal to the radius; therefore, the opening of the compasses required for striking the circle gives this arc at once to start with. An arc 90°, or a quadrant, is obtained by bisecting 60° and adding the half. By continual bisection of 60°, the finer graduations are produced. The amount of care, patience, skill, and delicacy of touch required in the original graduation of important astronomical instruments, is such, that not above one or two men in a generation have been found competent to the task, and these have become almost as famous as the astronomers who have successfully used the instruments. It would be out of place here to point out in detail the minute precautions and methods of correction that are adopted in this most delicate manipulation; but, as an example, we may mention the fact, that Graham, when dividing the mural quadrant for the Greenwich observatory, measured his larger chords from a scale made for the purpose; but before laying these down on the quadrant, he left the scale, beam-compasses, and quadrant to stand for a whole night, in order to acquire exactly the same temperature, and that neglect of this precaution would have involved a notable amount of error. The necessity of such extreme accuracy will be understood when we consider the application that is made of these divisions. When, for example, the mariner determines his latitude by taking the meridian altitude of the sun, the graduated arc of the limb of the sextant or quadrant he uses represents, practically, the curved surface of the globe, and the error is magnified just to the same extent as the radius of the earth exceeds that of the divided arc of the instrument. Supposing this arc to be part of a circle of 60 inches' circumference, each degree will occupy $\frac{1}{6}$th of an inch. An error of $\frac{1}{100}$th of an inch in the division would thus mislead the mariner to an extent of more than four statute miles as regards his position on the waters. But such a ship's quadrant is but a coarse and rude instrument compared with astronomical instruments for measuring celestial angular distances by means of a divided arc; in these, an error of a thousandth part of an inch would be regarded as one of serious magnitude.

The methods of *original graduation* above described are not practically adopted except for the largest and most important astronomical or geodesical instruments. Ordinary instruments are graduated by dividing plates or engines which copy and adapt a set of already existing divisions. The dividing-plate which is used for common purposes, such as dividing compass rings, etc., is a divided circle with a steel straight-edge, made movable on the axis or arbor of the plate in such a manner that its edge during every part of its revolution shall fall in the exact line from center to circumference. The ring, protractor, or other instrument to be divided, is clamped upon the plate with its center exactly coinciding with that of the plate, and the straight-edge is moved round, and made to halt at the required divisions on the circumference of the dividing-plate, and by using the steel straight-edge as a guide, corresponding divisions are marked off upon the concentric arc of the instrument to be divided. The *dividing-engine* is a very complex machine, requiring the greatest accuracy and care in its construction; so much so, that the possession of a good one affords the means of obtaining a very good income, with a moderate amount of labor in using it. Such was the case with the instrument of Mr. Parsons of London, who for many years divided a large proportion of the best theodolites, sextants, etc., that were made in this country. Among the most celebrated dividing-engines may be mentioned those of Ramsden, Troughton, Simms, and Ross. A detailed account of the construction of these would far exceed our limits. Their principal parts consist of a large circle divided with extreme care by original graduation. This wheel is racked on its edge with teeth as equal and accurate as the divisions; a very carefully constructed endless screw works in these teeth, and is moved through any given number of revolutions, or any measured fraction of a revolution, by means of a treadle or other suitable power, thus making the requisite steps for each division; another part of the machine cutting a fine line at the moment of the halt of each step.

These divisions are cut upon an arc of silver, gold, or platinum, which is soldered or inlaid upon the limb of the instrument, the precious metals being used, on account of the oxidation to which common metals are liable.

GRÆCIA, MAGNA. See MAGNA GRÆCIA.

GRÆVIUS, the Latinized form of GRÆFE, JOHN GEORGE, 1632–1703; one of the most learned and laborious writers of his time, b. Saxony. He began his studies in the gymnasium of Pfota, and completed them at the university of Leipzig, under Rivinus and Strauch. Grævius was led to the study of letters by his natural inclination, and every day he became more and more devoted to this pursuit. But his father wished that he should study the law; Strauch seconded this view, and Grævius obeyed, though with repugnance. He had the curiosity to visit Holland, while Salmasius, Heinsius,

and Frederic Gronovius, were in the zenith of their reputation. The conversation of Gronovius revealed to him the painful truth that his studies had been almost entirely unavailing, that he had been taught according to the principles of a bad school, and that he had no time to lose if he desired to correct the vices of its method of instruction. He entreated Gronovius to become thenceforth his guide; so, having abandoned jurisprudence, he passed two years at Deventer, attending assiduously the lessons of his new master. He then proceeded to Amsterdam to hear Alexander Morus and David Blondel, whose counsels decided him to quit Lutheranism for the sect of Calvin. Grævius, whose reputation had now begun to be extended, was, in 1656, called to the university of Duisburg; and he had been there two years, surpassing all the hopes which had been conceived of his talents, when Gronovius, who had entered the university of Leyden, solicited the magistrates of Derventer to appoint Grævius his successor. They agreed to this application, and Grævius, notwithstanding the efforts of the elector of Brandenburg, who, in order to retain him, offered an augmentation of fees, quitted a university for a simple gymnasium, influenced probably by a desire of living under a free government. After a stay of three years at Deventer, he yielded to the solicitations of the university of Utrecht, which offered him the chair of history, then vacant by the death of Æmilius. This satisfied all his ambition, and, content with his situation, he declined the invitations of the magistrates of Amsterdam and Leyden, who twice attempted, by brilliant offers, to attach him to the schools in those cities. The elector-palatine, who wished to draw him to Heidelberg, was also refused; the king of Prussia was not more fortunate; and the republic of Venice, which offered him a chair in the university of Padua, had as little success, although, in the hope of inducing him to accept, it had promised him, besides considerable appointments, full liberty on the score of religion, and complete protection against the inquisitors. But none of these offers could overcome his resolution. The eager desire of foreigners to obtain his services was justified by the great reputation which he had attained as professor. Pupils crowded to his lectures, not only from all Holland, but from all Europe. In Germany particularly, almost all the great lords sent their sons to be educated by him; and he reckoned amongst his auditors sons of princes and even kings; for William III., who made him his historiographer, had confided to his care the young prince of Nassau. [*Encyc. Brit.*, 8th edit.]

GRAF, the German equivalent for count (q.v.), *comte*, comes, and for our earl (q.v.). The etymology of the word is disputed, but the most probable conjecture seems to be that it springs from the same root with the modern German *raffen* and the Anglo-Saxon *reafan*, to snatch or carry off hastily; and also with our words *reve*, *greve*, and the last syllable of *sheriff*. If this view be correct, the graf, in all probability, was originally a fiscal officer, whose duty it was to collect the revenue of a district. The title first appears in the *lex salica* (compiled in the 5th c.) under the Latinized form of *grafio;* at a later period, the office is often designated by the Latin equivalent of *comes*. Charlemagne divided his whole kingdom into graf-districts (*grafengaue*) or counties, each of which was presided over by a graf. The people were in the habit of appointing a representative called the *cent-graf* to attend to their interests with the graf, and probably, if necessary, to appeal from his decisions to the central government. Then there was the *stall-graf*, or stable graf; the *comes stabuli*, or constable of later times; the *pfalzgraf* (*comes palatii*) who presided in the domestic court of the monarch, which as such was the highest court in the realm; the *send-graf*, who was sent as an extraordinary deputy of the king to control the ordinary *gau-grafen;* and lastly, the *mark-graf*, or marquis, on whom the important duty of defending the border-lands devolved. When feudal officers became hereditary, and the power of the princes of the empire, secular and ecclesiastical, developed itself, the graf gradually ceased to be an officer possessed of real power, and became merely a titled noble. In Germany, in modern times, there are two classes of grafs: those who are representatives of the old grafel families, who held sovereign jurisdiction immediately under the crown (*landeshoheit*), and who still belong to the higher nobility, their chief taking the title *Erlaucht* (illustrious); and those who form the highest class of the lower nobility. The former is a very small, the latter, an extremely numerous class of persons.

GRÄFE, Albrecht von, 1828–70; son of Karl Ferdinand, an oculist, professor of ophthalmology in Berlin university. He had remarkable practical skill, and published many important papers on the eye and its diseases.

GRÄFE, Alfred Karl, b. 1830; nephew and assistant of Albrecht; graduated at Halle, where he became a professor. He founded there an ophthalmic hospital which attracted many thousands of patients. He has published books and papers on ophthalmology.

GRÄFE, Karl Ferdinand von, 1787–1840; b. Warsaw; graduated at Leipsic, and in 1811 was professor of surgery in Berlin. He superintended Napoleon's military hospitals, and after the war was on the medical staff of the army. In England he was warmly received, being the guest of George IV. He went to Hanover to perform an operation on the eyes of the crown prince, but died suddenly. He revived the surgical operation of replacing portions of the face removed by disease, or otherwise by skin taken from other parts of the same body, and wrote a work advocating this treatment entitled *Rhinoplastik*.

GRA'FENBERG, a little village in Austrian Silesia, is an extension of the town of Freiwaldau towards the north, and is celebrated as the spot where the water-cure (see HYDROPATHY) was introduced about the year 1828 by Priesznitz. The village is situated at an elevation of 1200 ft. above the level of the Baltic sea; the climate is inclement, and the vegetation scanty. It extends from the valley, half-way up the Gräfenberge. The lodgings for visitors are partly in the buildings connected with the baths, partly scattered on the declivity of the hill, or in Freiwaldau.

GRAFFI'TI (Ital. *graffito*, a scratching), a class of ancient inscriptions to which attention has recently been called, and of which several collections have been made, or are in progress. The graffito is a rude scribbling or scratching with a stylus, or other sharp instrument, on the plaster of a wall, a pillar, or a door-post. Such scribblings are pretty commonly found on the substructions of Roman ruins, as in the golden house of Nero, the palace of the Cæsars and the Palatine, and in still greater numbers in Pompeii and in the Roman catacombs. Their literary value, of course, is very slight; but as illustrating the character and habits of a certain class of the ancient Romans, and what may be called the "street-life" of the classic period, they are deserving of study. A small collection of Pompeiian graffiti was published in 1837 by Dr. Wordsworth; but the most complete, or, at all events, the most popular collection, is that of Padre Garrucci, a Neapolitan Jesuit, which was published in Paris in 1856. Greek graffiti occasionally are found upon Roman ruins, but they are commonly in Latin, and in a few instances at Pompeii, in the ancient Oscan. A few specimens may not be uninteresting.

Some of them are idle scribblings, such as we may suppose some loiterer to indite at the present day: thus, some lounger at the door of a wine-shop at Pompeii amuses himself by scratching on the door-post the tavern-keeper's name *Taberna Appii* ("Appius's Tavern"). In other cases, we meet with some scrap of rude pleasantry or scandal, such as not unfrequently defaces the walls of our own towns or villages; thus, *Auge amat Arabienum* ("Auge is in love with Arabienus"). Many rude sketches also are found upon the walls, some of them evidently caricatures, others seriously meant, and grotesque from the extreme rudeness. A great many of the subjects of those sketches are gladiatorial.

By far the largest proportion of the graffiti are from Pompeii, but many have also been discovered at Rome, and some of them are of a most interesting character. One discoverrd by Father Garrucci in 1856, in a subterranean chamber of the palace of the Cæsars, possesses a strange and truly awful interest, as a memorial of the rude early conflicts of paganism with the rising Christian creed. It is no other than a pagan caricature of the Christian worship of our Lord on the cross, and contains a Greek inscription descriptive of one Alexamenus as engaged in worshiping God. The chamber in which it was found appears to have been a waiting-room for slaves and others of inferior grade.

The graffiti of the catacombs are almost all sepulchral, and are full of interest as illustrating early Christian life and doctrine.—See for the whole subject the *Edinburgh Review*, vol. cx. pp. 411–437.

GRAFF-REI'NET, the chief t. of the division of that name, is one of the most important and prosperous towns in Cape Colony. The number of inhabitants is about 3,800. During the ten years immediately preceding 1857, it had risen from an inland village to be a great center of commerce, having its public library, its college, its agricultural society, its banks, its newspapers, and steam and water mills. It owes its advancement partly to its position between Port Elizabeth and the northern boundary, but principally to its being the business center for the midland province. It is situated on the Sunday, which enters Algoa bay, near Port Elizabeth.

GRÄ'FRATH, a t. of Rhenish Prussia, in the government of Düsseldorf, and 12 m. e. by s. from Düsseldorf, on the Itter. It has manufactures of cotton goods, silk ribbons, and iron-ware; and has recently much increased in manufacturing industry, wealth, and population. Pop. '75, 5,620.

GRAFTING, the uniting of a young shoot (*scion*) of one kind of plant to a stem (*stock*) of another kind, so that the scion may receive nourishment from the stock. Grafting has been practiced from ancient times, as may be seen from passages in the New Testament, and in Virgil and other Latin classics; although it cannot be certainly traced to a more remote antiquity; and its introduction among the Chinese is ascribed to Roman Catholic missionaries. It is a most important part of the art of gardening, and is practiced for various purposes, but chiefly for the perpetuation and propagation of the finest varieties of fruit-trees, which could not be accomplished by seed, and is accomplished by grafting more rapidly and easily than by layers or cuttings. Besides this, however, grafting is of great use in hastening and increasing the fruitfulness of fruit-trees; the circulation of the sap being impeded at the junction of the stock and scion—as by a deep wound, removal of bark, or the like—more particularly when there is a considerable difference between the stock and scion; and repeated grafting (technically, *working*) is often resorted to by gardeners to obtain flowers and fruit much sooner than would naturally be the case. Grafting is also employed to turn to account the vigor of a root and stem of which the branches are exhausted or otherwise unproductive, and large

crops of fruit may often be thus obtained in a garden much sooner than by any other means.

In grafting, it is particularly to be attended to that the *alburnum* (q.v.) of the scion is brought into contact with that of the stock. The hard wood of the one never unites with that of the other, remaining separate and marking the place of the operation even in the oldest trees. For scions or grafts, pieces of about 6 to 8 in. long are generally taken from the shoots of the previous summer, with several buds, but portions of shoots of two years old are sometimes successfully employed. The time for grafting is in spring, as soon as the sap begins to appear. The scion should, if possible, be taken from a healthy and fruitful tree, but scions from the extremities of lateral branches are more likely to become speedily fruitful than those from the uppermost branches, where growth is most vigorous. The scion should be kept for a few days before grafting, so that the stock may rather exceed it, not only in vigor, but in the progress of its spring growth; and for this purpose may be placed in the ground, in a rather dry soil, sheltered from the direct rays of the sun. Scions may be kept for some time, and easily carried to a distance, by sticking their lower end into a potato. The end should always be freshly cut off when the scion is to be used. There are various modes of grafting. *Cleft-grafting* is very commonly practiced when the stock is very considerably thicker than the scion. The stock being cut over, is cleft down, and the graft, cut into the shape of a wedge at its lower end by a sharp thin knife, is inserted into the cleft. This mode of grafting is particularly applicable to branches of large trees, when the introduction of a new variety of fruit, or increased fruitfulness, is sought.—*Crown-grafting* is used for still thicker stocks, which are cut across, and then cleft down by two clefts crossing one another at right angles, two scions being inserted close to the bark in each cleft; or no cleft at all is made, and any desired number of scions obliquely cut away on one side are simply inserted between the bark and wood of the stock, the operation in this case being deferred till the bark readily parts from the wood. In this kind of grafting, a longitudinal slit in the bark of the stock, opposite to each graft, is advantageous.—*Tongue-grafting* is the mode most commonly practiced for young trees in nurseries. For this, it is necessary that the stock and the scion should be of not very different thickness. A slit or a very narrow angular incision is made in the center of the stock downwards, and a similar one in the scion upwards, both having been first cut obliquely, at corresponding angles, and the tongue thus made in the scion being inserted into the incision in the stock, they are fastened very closely and thoroughly together.—In *saddle-grafting*, the end of the stock is cut into the form of a wedge, and the scion is affixed to it, the base of the scion having been cut or slit up for the purpose.—*Shoulder-grafting*, used chiefly for ornamental trees, is performed by cutting obliquely and then cutting across a small part at the top of the stock, so as to form a shoulder, the scion being cut to fit it.—*Peg-grafting*, not now much in use, is accomplished by making the end of the scion into a peg, and boring the top of the stock to receive it.

Whichever of these modes of grafting is adopted, the graft must be fastened in its place by tying, for which purpose a strand of bast-matting is commonly used. The access of air is further prevented by means of clay, which has been worked up with a little chopped hay, horse or cow dung and water, and which is applied to the place of junction so as to form a ball, tapering both upwards and downwards. In France, a composition of 28 parts black pitch, 28 Burgundy pitch, 16 yellow wax, 14 tallow, and 14 sifted ashes, is generally used instead of clay. Gutta-percha, applied in a soft state, has also been used, or even blotting-paper held fast by strips of sticking-plaster. The progress of the buds shows the union of the graft and stock, but it is not generally safe to remove the clay in less than three months; and the ligatures, although then loosened, are allowed to remain for some time longer. From some kinds of fruit-trees, fruit is often obtained in the second year after grafting.

Budding (q.v.) is in principal the same as grafting; and *flute-grafting* is a kind of budding in which a ring of bark is used instead of a single bud, and a stock of similar thickness having been cut over, a ring of bark is removed, and the foreign one substituted. This is commonly performed in spring, when the bark parts readily, and is one of the surest modes of grafting.—*Inarching* (q.v.), or *grafting by approach*, in which the scion is not cut off from its parent stem until it is united to the new stock, is practiced chiefly in the case of some valuable shrubs, kept in pots, in which success by the ordinary methods is very doubtful.

An effect is produced by the stock on the scion which it nourishes analogous to that of a change of soil; much of the vigor of a strong healthy stock is also communicated to a scion taken even from an aged tree. There is, moreover, in some degree, an influence of the elaborated sap descending from the scion on the stock which supports it. An important part of the practical skill of the gardener or nurseryman consists in the selection of the proper kinds of stocks for different species and varieties of fruit-trees. The stock and scion, however, must not be of species extremely dissimilar. No credit is due to the statements of ancient authors about vines grafted on fig-trees, apples on planes, etc., the semblance of which can only have been brought about by some delusive artifice; for all attempts at grafting fail except among plants of the same genus, or at least of the same natural family.

Herbaceous plants with firm stems, as dahlias, are sometimes grafted. Some kinds of plants, of small size, in pots, are placed in moist hothouses or hotbeds, under bell-glasses, whilst the junction of the scion and stock is going on, which in these circumstances takes place very surely and very expeditiously. But an accumulation of too much moisture under the bell-glass must be guarded against.

GRAFTON, a co. in w. New Hampshire, bordering on Vermont, drained by the Pemigewasset and the lower Ammonoosuck, and crossed by the Concord and Montreal, and the Northern railroads; 1463 sq.m.; pop. '70, 39,103; in '80, 38,791. The surface is rough, embracing several high peaks of the White mountains. Squam lake is one of the physical features. The productions are mainly agricultural, but considerable manufacturing is done. An immense quantity of maple sugar is produced here annually. Co. seat, Haverhill.

GRAFTON, a t. in Worcester co., Mass., on the Blackstone and Quinsigamond rivers, and the Boston and Albany, and Providence and Worcester railroads; 38 m. s.w. of Boston; pop. '80, 4,030. There are extensive manufactories of boots and shoes, cotton-mills, churches, banks, newspapers, and a high school.

GRAFTON, JOSEPH, 1757–1836; b. Newport, R. I. He worked at sail-making, his father's trade, at the age of 14. In 1776 he commenced preaching as a Congregationalist, but in 1787, joined the Baptists, and in the following year was ordained pastor of the First Baptist church, Newton, Mass. He was one of the founders and a trustee of the Newton theological seminary. His ministry of nearly 50 years was very successful.

GRAGNA'NO, a t. of 8,000 inhabitants, in the province of Naples, 2 m. s.e. of Castellamare, is situated on the flank of Mt. Gaurano, from which it is said to have derived its name. The origin of this town dates from the great eruption of Vesuvius in 79 A.D., when the inhabitants of Stabia, in dread of the vicinity of the volcano, fled from their dwellings, and sought refuge on the mountain of Gaurano. Gragnano lies in a beautifully picturesque neighborhood, which produces excellent wines, and has good macaroni manufactories.

GRAHAM, a co. in n.w. Kansas, on the s. fork of Salmon river; 900 sq.m.; pop. 96. It is a wild and but little settled region.

GRAHAM, a co. in w. North Carolina, bordering on Tennessee, intersected by Little Tennessee river; 300 sq. miles. It is rough, and in some parts mountainous, with good soil in the valleys. Co. seat, Robbinsville.

GRAHAM, CHARLES R., an American engineer and soldier, b. in New York city in 1824. After completing his college course, he entered the U. S. navy as a midshipman. The war with Mexico breaking out shortly afterwards, the vessel to which he was attached was sent to take a part therein. He now began to study engineering, and when the war ended he returned to New York and placed himself under competent instructors until he had mastered his chosen profession. He was for several years constructing engineer of the Brooklyn navy-yard. The dry-dock and landing-ways of that establishment were constructed under his supervision. When the rebellion of 1861 broke out, he volunteered his services to defend the government, and entered the army of the Potomac as maj. of Excelsior guard. In the battle of Gettysburg he served as brig.gen., and was severely wounded. Recovering from his wounds, he again enlisted, and was assigned by gen. Butler to the command of a gun-boat flotilla, and ordered to proceed to Bermuda Hundred, on James river, and hold the place until the navy could have time to arrive. In this movement he was successful. Subsequently, till the close of the war, he was actively engaged in the field. After the war was over, he returned to New York and resumed the practice of his profession. In 1873, he was appointed chief engineer of the department of docks.

GRAHAM, FAMILY OF. See MONTROSE.

GRAHAM, ISABELLA, an eminent philanthropist, b. in Lanarkshire, Scotland, July 20, 1742; d. in New York July 27, 1814. Her maiden name was Marshall; her husband, John Graham, to whom she was married in 1765, was a British army surgeon, who died in Antigua in 1774. Mrs. Graham afterwards taught school in Paisley and in Edinburgh, but in 1789 came to New York and established a school for young ladies. *The Penny society* of Edinburgh, which was afterwards developed into *The society for the relief of the destitute sick*, was organized by her instrumentality; and on coming to New York she engaged in promoting the organization of similar societies. *The society for the relief of poor widows; the orphan asylum society; the society for promoting industry among the poor;* and the first *Sunday school for ignorant adults*, were all organized partly or wholly through her instrumentality. She was the first president of the *Magdalen society*, and was very active in missionary labors among the poor. Her memoirs, written by the rev. Dr. Mason, were published in 1816, and her letters and correspondence, prepared by her daughter, Mrs. Bethune, appeared in 1838.

GRAHAM, Sir JAMES ROBERT GEORGE, THE RIGHT HONORABLE, of Netherby, Cumberland, statesman, eldest son of sir James, the first baronet, by lady C. Stewart, eldest daughter of the seventh earl of Galloway, was b. June 1, 1792. The Grahams of Netherby are a junior branch of the Grahams of Esk, viscounts of Preston, descended

from the earls of Stratherne and Menteith. Graham was educated at Westminster school, whence he proceeded to queen's college, Cambridge. He afterwards became private secretary to lord Montgomerie, the British minister in Sicily, during the most critical period of the war, and the entire management of the mission devolved upon him at a most important moment, in consequence of the illness of his chief. On the arrival of lord W. Bentinck, he was continued in his post, and he afterwards accepted a military situation attached to the person of lord William, who was commander-in-chief in the Mediterranean. He was sent in this capacity to Murat, with whom, at Naples, he negotiated the armistice which separated that general from Napoleon. In 1818 he was returned for Hull on whig principles; but at the next election, in 1820, lost his seat, and some years elapsed before he re-entered parliament. In 1824 he succeeded to the baronetcy on the death of his father. In 1826 he was returned for Carlisle as a whig, and a warm supporter of Catholic emancipation He displayed so much ability in opposition, that earl Grey offered him, in 1830 the post of first lord of the admiralty, with a seat in the cabinet. He was also one of the committee of the cabinet appointed to discuss and settle the provisions of the first reform bill. He was at this time very popular with the extreme liberal party, and was supposed to be, of all the members of the Grey cabinet, most favorable to radical changes. In 1834 he seceded from the government, with Mr. Stanley, on the appropriation clause of the Irish church temporalities act. He refused to join the Peel administration in that year, but gradually in opposition approximated to the politics of that statesman; and in 1841 became secretary of state for the home department in the government of sir Robert Peel, who on one occasion declared that Graham was the ablest administrator and the best man of business he had ever known. In 1844 he issued a warrant for opening the letters of Mazzini, and caused the information thus obtained to be communicated to the Austrian minister, an act by which the ministry, and Graham in particular, incurred great obloquy. He also encountered great displeasure n. of the Tweed by his high-handed method of dealing with the Scottish church during the troubles which ended, contrary to his anticipation, in the disruption, and the formation of the free church. He gave Peel a warm support in carrying the corn law repeal bill, and resigned office with his chief as soon as that great measure was carried. On the death of Peel in 1850, he became leader of the Peelite party in the lower house, and led the opposition to the ecclesiastical titles bill. In Dec. 1852, he took office in the coalition ministry of the earl of Aberdeen, and accepted his old office of first lord of the admiralty. This was a post much below his talents and pretensions, but he held it until Feb. 1855. Graham refused to take office either in the first or second administration of lord Palmerston, but he gave that minister a general support. He died from disease of the heart, Oct. 25, 1861. When the house of commons again met, it felt that it had lost one who stood in the first rank of statesmen. His commanding stature, fine personal presence, his calm and impressive delivery, his ripe and gentle wisdom, poured forth in a stream of quiet, yet winning and persuasive eloquence, made him the Nestor of the house of commons. Yet his changes of opinion, from the whiggism of his youth to the vehement conservatism of his manhood, and the radicalism of his old age, exposed him to incessant and well-founded charges of political inconsistency.

GRAHAM, JOHN, Viscount DUNDEE, was the eldest son of sir William Graham of Claverhouse, head of a branch of the noble family of Montrose, in Forfarshire. He was b. in 1648, entered St. Andrews university in 1665, served in the French army from 1668 till 1672, next entered the Dutch service as cornet in the prince of Orange's horse guards, and is reported (but on no good authority) to have saved the life of the prince at the battle of Seneffe in 1674. Returning to Scotland, he obtained (Feb. 1678) an appointment as lieut. in a troop of horse commanded by his cousin, the third marquis of Montrose. At this time, the government of Charles II. was engaged in its insane attempt to force episcopacy upon the people of Scotland. A system of fines and military coercion had been carried on for years against all nonconformists; conventicles and field-preachings were prohibited, penalties were inflicted on all who even harbored the recusants, and the nation lay at the mercy of informers. Maddened by oppression, and fired by a fierce zeal for the covenant, the people flew to arms; but their efforts were irregular and detached, and each successive failure only aggravated their sufferings. Many were executed, the jails were filled with captives, and those who fled were outlawed, and their property seized. In this miserable service Graham now engaged. He encountered an armed body of covenanters at Drumclog, June 1, 1679, but was defeated, about forty of his troopers being slain, and himself forced to flee from the field. Three weeks afterwards (June 22), he commanded the cavalry at Bothwell bridge, where the royal forces, under the duke of Monmouth, achieved an easy victory over the covenanters. In this battle, three or four were killed while defending the bridge, but in the pursuit, 400 were cut down (chiefly by Graham's dragoons), and 1200 surrendered unconditionally, to be afterwards treated with atrocious inhumanity. These affairs at Drumclog and Bothwell are the only contests that can even by courtesy be called battles in which Graham was engaged in Scotland previous to the abdication of James II. They gave no scope for valor, and displayed no generalship. In his other duties—pursuing, detecting and hunting down unyielding covenanters—Graham evinced the utmost

zeal. He rose to the rank of maj.gen., was sworn a privy councilor, had a gift from the crown of the estate of Dudhope, and was made constable of Dundee. In 1688, on the eve of the revolution, he was raised to the peerage by James II. as viscount Dundee and lord Graham of Claverhouse. When the bigotry of James had driven him from the throne, Dundee remained faithful to the interests of the fallen monarch. He was joined by the Jacobite highland clans and by auxilaries from Ireland, and raised the standard of rebellion against the government of William and Mary. After various movements in the north, he advanced upon Blair in Athol, and gen. Mackay, commanding the government forces, hastened to meet him. The two armies confronted each other at the pass of Killiecrankie, July 27, 1689. Mackay's force was about 4,000 men; Dundee's, 2,500 foot, with one troop of horse. A few minutes decided the contest. After both armies had exchanged fire, the highlanders rushed on with their swords, and the enemy instantly scattered and gave way. Mackay lost by death and capture 2,000 men; the victors, 900. Dundee fell by a musket-shot while waving on one of his battalions to advance. He was carried off the field to Urrard house, or Blair castle, and there expired. In the Bodleian library, Oxford, is preserved the letter-book to Nairne, private secretary to James II., and in this book is a copy of a letter purporting of be written by Dundee after he had received his death-wound, giving James a short account of the victory. The letter was first published in Macpherson's *Original Papers*, 1775, and has been treated as a forgery; but Nairne could have had no conceivable motive for forging such a document, which remained unprinted above 80 years.

The character and services of Dundee have been greatly exaggerated and blackened by party spirit. With the Jacobites, he was the brave and handsome cavalier, the last of the great Scots and gallant Grahams. With the covenanters, he was "bloody Claverse," the most cruel and rapacious of all the mercenary soldiers of that age. He was neither the best nor the worst of his class. As a military commander, he had no opportunities for display. He was the hero of only one important battle, and in that his skill was shown chiefly in his choice of position. As a persecutor, he did not, like Dalyell, introduce the thumb-screw, nor, like Grierson of Lagg, drown helpless women at stakes on the sea-sands. "In any service I have been in," he said, "I never inquired further in the laws than the orders of my superior officers;" and in Scotland he had very bad superior officers—low-minded, cruel, relentless taskmasters. It was fortunate for his reputation that he died after a great victory, fighting for an exiled and deserted monarch. See *Memorials and Letters illustrative of the Life and Times of John Graham of Claverhouse;* by Mark Napier (1862).

GRAHAM, SYLVESTER, 1794–1851; b. Conn, He studied at Amherst, and about 1826 entered the ministry of the Presbyterian church. A few years later he became a temperance advocate, and based his cure for alcoholism upon the facts of physiology and proposed radical reforms in diet. His main points were entire abstinence from meat, and an improvement in the making of bread. *Graham bread* has become a settled name for the article made of unbolted wheat flour. He published several works, among which were *The Science of Human Life; Charity; Bread and Bread Making;* and one volume of *Philosophy of Sacred History.*

GRAHAM, THOMAS, a celebrated chemist, was born in Glasgow in the year 1805. Having studied at Glasgow and Edinburgh, he became, in 1830, professor of chemistry at the Andersonian university, and continued in that office till 1837, when he succeeded Dr. Turner in the chemical chair of University college, London. In 1855, he was appointed master of the mint, and resigned his professorship. From the year 1831, in which his memoir, *On the Formation of Alcoholates, Definite Compounds of Salts and Alcohol,* appeared in the *Transactions of the Royal Society of Edinburgh,* to the time of his death, he was constantly publishing important contributions to chemistry. Amongst the most important of his memoirs we may mention the following: *On the Law of Diffusion of Gases* (*Tr. R. Soc. Edin.* 1834); *Researches on the Arseniates, Phosphates, and Modifications of Phosphoric Acid* (*Phil. Tr.* 1833); *On the Motion of Gases, their Effusion and Transpiration* (*Ibid.* 1846 and 1849); *On the Diffusion of Liquids* (*Ibid.* 1850 and 1851); *On Osmotic Force* (*Ibid.* 1854); *Liquid Diffusion Applied to Analysis,* and *On Liquid Transpiration in Relation to Chemical Composition* (*Ibid.* 1861). In addition to these memoirs, he brought out an excellent treatise on chemistry, which has passed through more than one edition. Graham was one of the founders and first president of the chemical and the Cavendish societies, was a fellow of the royal society, and was more than once appointed one of its vice-presidents. He was likewise frequently placed by government on important scientific commissions. He died Sept. 16, 1869.

GRAHAM, WILLIAM ALEXANDER, 1804–75; b. N. C., and bred to the law. He was a member of the state legislature, where he was speaker of the lower house; was chosen to the U. S. senate in 1841, governor of North Carolina, 1845–49, and under president Fillmore was secretary of the navy until June, 1852. When gen. Scott ran for president in 1852, Graham was on the ticket as candidate for vice-president. His last public office was that of senator in the confederate congress.

GRAHAME, JAMES, a Scottish poet, son of a legal practitioner, was b. in Glasgow, April 22, 1765, and was educated at the university of that city. He removed to Edinburgh in 1784, where he commenced the study of law under the tuition of a relative,

and was admitted a member of the society of writers to the signet in 1791, and in 1795, of the faculty of advocates. Finding the legal profession unsuited to his tastes, and having a sufficiency of worldly means, he withdrew from professional practice, and devoted himself to the cultivation of his muse. He had long regarded the life and duties of a country clergyman with a wistful eye, and an opportunity offering, he took orders in the church of England, being ordained by the bishop of Norwich on Trinity Sunday, May 28, 1809. He was successively curate of Shipton in Gloucestershire, and of Sedgefield in the county of Durham. Ill health compelled him to abandon his sacred duties, and he returned to Scotland; spending a few days in Edinburgh, he proceeded to Glasgow, and died at his brother's residence, near that city, on Sept. 14, 1811, in the forty-seventh year of his age.

Grahame has left behind several poetical works, the chief of which are *Mary Queen of Scots*, a dramatic poem; *The Sabbath; The Birds of Scotland;* and *The British Georgics.* It is on *The Sabbath* that his fame rests. He was a retiring, amiable, and affectionate man, and possessed a deep love for nature, and those passages in his poems are the best that give utterance to that love. There was nothing bold or mounting in his genius, but he had a plenteous command of musical verse and rural imagery.

GRAHAME, JAMES, 1790–1842; b. in Scotland, and practiced law. In 1826, he began a history of the United States which he brought down to 1776. The work has been several times republished, and has received high praise. He was attacked by Bancroft the historian, and by Josiah Quincy in a special volume. Grahame was partial to America, and coveted the name of American citizen. He wrote against slavery, and made a special defense of the Scottish Covenanters from the charges and insinuations in *Scott's Tales of my Landlord.*

GRAHAME'S or HOTHAM'S ISLAND. A mass of dust, sand, and scoriæ thrown out of a submarine volcano in the Mediterranean, and which remained for some time above the surface of the water, received these names. It made its appearance about thirty miles off the coast of Sicily, opposite to Sciacca, in July, 1831. In the beginning of Aug., when the action of the volcano had ceased, it had a circumference of about a mile and a quarter, the highest point was estimated at 170 ft. above the sea, and the inner diameter of the crater about 400 yards. As soon as the eruption ceased, the action of the waves began to reduce the island, and before many months transpired, the whole mass of scoriæ and sand disappeared, being scattered as a stratum of volcanic cinder in that portion of the bed of the Mediterranean.

GRAHAM'S LAND, an island of the Antarctic ocean, discovered by Biscoe in Feb., 1832, lies in lat. 64° 45′ s., and long. 63° 51′ w., being nearly on the meridian of the east extremity of Terra del Fuego, and within a comparatively short distance of the polar circle. The position, as above defined, is precisely that of Mt. William, the highest spot seen. In front, towards the north, are a number of islets, called Biscoe's Range. No living thing, excepting a few birds, appears to exist.

GRAHAM'S TOWN, the capital of the eastern province of the Cape Colony, stands near the center of the maritime division of Albany. It is about 25 m. from the sea, in lat. 33° 19′ s., and long. 26° 31′ e.; and it contains about 8,000 inhabitants, chiefly English. Graham's Town is the seat of two bishops—one of the church of England, and another of the church of Rome, and possesses a cathedral. It has also several Wesleyan ministers, besides the pastors of the Dutch Reformed church. Among the other institutions of the place are its banks, insurance offices, a botanic garden, a public library, a general hospital, large barracks, and two newspapers.

GRAIN (Lat. *granum*, any small hard seed or particle), a term often used as equivalent to *corn*, denoting the seeds of the *cerealia.*

GRAIN, the smallest of weights in the English system, there being 5,760 in a troy and 7,000 in an avoirdupois pound. The name came from a grain of wheat, of which 32 taken from the best part of the ear and thoroughly dried were declared by parliament (in 1266) to make a pennyweight, 20 pennyweights an ounce, and (at that time) 12 ounces a pound. It takes nearly 15½ (15.452) grains to make a grain of metric weight.

GRAIN COAST. See GUINEA.

GRAIN ELEVATOR, a system of machinery run by steam or other power, consisting of an endless chain or belt for unloading grain from canal-boats, ships, cars, etc. The grain is raised by a continuous line of scoops or buckets, attached to the belt, and which deposit it in enormous bins, from which it is easily run into ships for export. In New York and Chicago these grain elevators are remarkable for their vast capacity for handling and storing grain.

GRAINES D'AVIGNON. See FRENCH BERRIES.

GRAINGER, or GRANGER, a co. in e. Tennessee between Holston and Clinch rivers, including the high ridge known as Clinch mountain; 300 sq.m.; pop. '70, 12,412—1030 colored. The surface is hilly, but the valleys are fertile, producing corn, oats, etc. Co. seat, Rutledge.

GRAINING, *Leuciscus Lancastriensis*, a fish of the family *cyprinidæ*, of the same genus with the dace (q.v.), which it much resembles. It was first pointed out as a different

species by Pennant, who found it in the Mersey. It occurs in a few English streams, and in some of the lakes of Switzerland. It is rather more slender than the dace. In its habits and food it resembles the trout, rises readily at the artificial fly, and affords good sport to the angler.

GRAINS OF PARADISE, or MELEGUETTA PEPPER, an aromatic and extremely hot and pungent seed, imported from Guinea. It is the produce of *amomum meleguetta*, or *A. grana paradisi*, a plant of the natural order *scitamineæ* or *zingiberaceæ*, with lanceolate leaves, one-flowered scapes (leafless stems), about 3 ft. high, and ovate or elliptic-oblong capsules containing many seeds. By the natives of Africa, these seeds are used as a spice or condiment to season their food; in Europe, they are chiefly employed as a medicine in veterinary practice, and fraudulently to increase the pungency of fermented and spirituous liquors. By 56 Geo. III. c. 58, brewers and dealers in beer in England are prohibited, under a heavy penalty, from even having grains of paradise in their possession. This drug is much used to give apparent strength to bad gin. The name meleguetta pepper, or Guinea pepper (q.v.), is also given to other pungent seeds from the west of Africa.

GRAKLE, the common name of many birds of the starling family (*sturnidæ*), all tropical or sub-tropical. They have very much the habits of starlings, and some of them even excel starlings in their imitative powers, and particularly in the imitation of human speech. This is remarkably the case with the mina birds (q.v.) of the East Indies, which may be regarded as grakles. Numerous species inhabit Africa. Some of them are birds of splendid plumage. The PARADISE GRAKLE (*gracula gryllivora*) of India has acquired a peculiar celebrity as a destroyer of locusts and caterpillars. It is about the size of a blackbird. Buffon tells us, that in order to stop the devastations of locusts in the island of Bourbon, this bird was introduced from India by the government. The grakles, however, beginning to examine the newly-sown fields, excited the alarm of the planters, and were exterminated; but it was found necessary, after a few years, again to introduce them, and they are now very numerous, although they do not confine themselves to insect food, but in default of it are ready to betake themselves to seeds and fruits. They sometimes enter pigeon-houses and feed on the eggs, or even on the newly-hatched young. When tamed, they become very pert and familiar, and exhibit a great aptitude for imitating the voices of animals. A grakle of this species, kept in a farm-yard, has been known to imitate most of its ordinary sounds, as those of dogs, sheep, pigs, and poultry.—Some of the grakles are known as summer birds of passage in the northern parts of America.

GRALL'Æ, or GRALLATORES, (Lat. stiltwalkers), an order of birds, generally characterized by very long legs, the *tarsus* (shank) in particular being much elongated, and by the nakedness of the lower part of the tibia, adapting them for wading in water without wetting their feathers. They have also generally long necks and long bills. The form of the bill, however, is various; and in its size, strength and hardness, it is adapted to the kind of food; some, as snipes, which feed chiefly on worms and other soft animals, having a very soft weak bill, whilst others, which feed on larger and stronger animals, have the bill proportionately large and strong. The form of the body is generally slender. The greater number of the grallæ are inhabitants of the sea-coast or of marshy districts. Many are birds of passage. Even those which are not aquatic are generally driven from the district which they frequent either by frost or drought. Cuvier divided this order into *brevipennes* (q.v.), (ostrich, cassowary, emu, etc.); *pressirostres* (bustards, plovers, lapwings, etc.); *cultrirostres* (cranes, herons, storks, adjutants, spoonbills, etc.); *longirostres* (snipes, curlews, godwits, sandpipers, etc.); and *macrodactyli* (rails, crakes, coots, etc.). The *brevipennes* are constituted by some into a distinct order, *cursores*, and differ very widely in many respects from the true grallæ.

GRAM. See CHICK PEA.

GRAM is the standard unit of French measures of weight, and is the weight of a cubic centimètre of distilled water at 0° centigrade (corresponding to 32° Fah.); the other weights have received names corresponding to the number of grams they contain, or the number of times they are contained in a gram: in the former case, the Greek numerals deca, hecto, kilo, myria, expressing weights of 10 grams, 100 grams, 1000 grams, 10,000 grams; in the latter case, the Roman numerals deci, centi, are prefixed, to express tenths, hundreths of a gram. Starting from the relation between the English yard and the French mètre, we are enabled to compare the units of weight, and it is found that a gram = 15.43248 grains Troy, from which the equivalents in English measure for the other weights can easily be found: thus—

		Grains Troy.		Lbs. Avordupois.		
Centigram	=	.1543234	=	.0000220462		
Decigram	=	1.543234	=	.000220462		
GRAM	=	15.43234	=	.00220462		
Decagram	=	154.3234	=	.0220462		
Hectogram	=	1543.234	=	.220462		
Kilogram	=	15432.34	=	2.20462		
Myriagram	=	154323.4	=	22.0462	=	.19684 cwt.
Quintal (q.v.)	=	1543234	=	220.462	=	1.9684 "

GRAMI'NEÆ. See GRASSES.

GRAMMAR, in its usual sense, and as applied to a particular language, investigates and systematizes the facts of that language, as exhibited in the most improved writers and speakers; the main divisions or heads being: (1) the way in which the sounds or spoken words are represented by letters (orthography); (2) the division of words into classes or "parts of speech," the changes or inflections they undergo, their derivation and composition (etymology): and (3) the way in which they are joined together to form sentences (syntax). A book embodying the results of such investigations, with a view to enable learners to understand a language, and to use it properly, is a grammar of that language.

Languages were not originally constructed according to rules of grammar previously laid down; but grammar rules were deduced from languages already in existence. In the days of Plato, perhaps the greatest master of language that ever wrote, the division of words into classes or parts of speech had not yet been made. Plato himself, according to Max Muller, took the first step in formal grammar by making the distinction of noun and verb, or rather of subject and predicate; for it was a distinction in the ideas or elements of a proposition he was making, rather than in the words themselves. Aristotle and the Stoic philosophers made further advances in the analysis of language, but they attended little to the forms of words, their object being logical rather than grammatical (see GENITIVE). It was the Alexandrian scholars, engaged in preparing critical editions of Homer and the other Greek classics, who first analyzed, classified, and named the phenomena of language as language; and it was one Dionysius Thrax, who had been trained in the Alexandrian school, and became a teacher of Greek (*grammaticus*, from Gr. *gramma*, a letter; as those who taught boys their Roman letters were called *literatores*) at Rome, that published the first practical systematic Greek grammar for the use of his Roman pupils (about 80 B.C.). This work, which still exists, though much interpolated, became the basis of all subsequent grammars, both Greek and Latin; and when grammars of the modern European tongues came to be written, they naturally followed the classical models. The chief matters treated of in grammar are considered under such heads as ADJECTIVE, CONJUNCTION, DECLENSION, etc.

In quite recent times, the study of language has advanced beyond this empirical stage, in which its object was confined to the explaining and teaching individual languages: and under the name of "comparative grammar," has brought to light the resemblances and differences of the various languages of the world, so as to classify them, after the manner of natural history, into families and minor groups, according to their greater or less affinities. Still higher questions, entering into the origin and growth of speech, and seeking to give a scientific account of its phenomena, now occupy the more advanced students of this subject. See LANGUAGE, INFLECTION.

GRAMMAR SCHOOLS received their name at a time when the grammar of the English language was not written, and when all knowledge of the principles of language could be obtained only through a study of the grammar of the ancient tongues, particularly Latin. The idea which lay at the basis of these institutions still pervades them, and the ancient languages are the principal subjects of instruction. History, geography, and modern languages have of late years been admitted into the curriculum of the great majority of these schools; but these subjects still hold a subordinate place, and distinction in Latin and Greek gives pre-eminence, and is the great object of ambition both to masters and pupils. Nor can it be otherwise so long as the universities recognize the ancient tongues as the only sound basis of a liberal education. For a further notice of the grammar schools of Great Britain, see PUBLIC SCHOOLS, NATIONAL EDUCATION.

GRAMMONT, a small t. of Belgium, in the province of East Flanders, is situated on both banks of the Dender, 20 m. s.s.e. of Ghent. It has manufactures of lace, fine linen, damask and woolen fabrics, and tobacco; and carries on cotton-spinning, dyeing, bleaching, tanning, distilling, and brewing. Pop. '70, about 9,000.

GRAMMONT, or **GRAMONT**, PHILLIBERT, Count of, a celebrated French courtier, son of Anthony, duke of Grammont, was b. about 1621. While still very young he served as a volunteer under Condé and Turenne, and distinguished himself by the most chivalric bravery. At the court of Louis XIV., with this reputation added to his youth, noble birth, a handsome person, fine talents and accomplishments, a lively wit, and strangely good fortune at play, at which he won such amounts as to support even his extravagant expenditures, it is no wonder that he became a favorite. He was distinguished for his gallantries, and even had the audacity to aspire to be the rival of the king in the affections of one of his favorites. This caused him to be banished from France; and he found a pleasant refuge and congenial society in the gay and licentious court of Charles II. of England. Here, after many adventures, he engaged to marry Eliza Hamilton, sister of Anthony, count Hamilton, but slipped out of London without fulfilling his promise. Two of the lady's brothers set off in pursuit of the forgetful Frenchman, and coming up with him at Dover, asked him "if he had not forgotten something." "Oh, to be sure," replied Grammont, "I have forgotten to marry your sister;" and returned to London to complete his engagement. He then went to France, where his wife became one of the ladies of the court of Maria Theresa of Austria. By this marriage he had two daughters, one of whom was married to Henry Howard, mar-

quis of Stratford, and the other became abbess of Poussay, in Lorraine. He died in 1707. See *Memoirs of the Comte de Grammont* by his brother-in-law, Anthony, count Hamilton (edited by sir Walter Scott in 1811; reprinted in Bohn's "extra volumes").

GRAMMONT, ORDER OF (or Grandmontains), monastics established at Limoges, France, in 1076, by the monk Stephen of Thiers, who was called *the corrector*. Gregory VII. brought them under the Benedictine rule, and at one time the order was strong in numbers and influence; but, like many others, it pined away, became corrupt, and disappeared with the revolution.

GRAMONT, or GRAMMONT, ANTOINE AGENOR ALFRED, Duc de, formerly duc de Guiche, b. Paris, 1819. He studied in the polytechnic school, but did not enter the army. In 1852 he was sent as minister to Cassel, and successively on diplomatic capacity to Stuttgart, Turin, and Rome. In 1861 he went as ambassador to Austria, remaining at Vienna nine years. In 1870 he was minister of foreign affairs in the Ollivier cabinet. When that cabinet resigned, he retired from public life. In 1873 he was made gen. of division. In 1877 he became a commander in the legion of honor.

GRAMPIANS, the name of the principal mountain system in Scotland. The system runs from n.e. to s.w., forming the well-known high grounds of Aberdeenshire, Kincardineshire, Forfarshire, and Perthshire. The average elevation of the summits of this main range is from 2,000 to 3,000 ft., and the highest elevation reached is that of Ben Nevis (4,406 ft.) at its western extremity. An outlying branch of the Grampians extends northward from near the head of the valley of the Dee, and comprises among its chief summits Ben Muicdhui (4,295 ft.) and Cairngorm (4,083 ft.). Southward of the western extremity of the Grampians are situated numerous groups and chains of greater or less extent. Among these the chief summits are Ben Cruachan (3,693 ft.), Ben Lomond (3,192 ft.), Ben More (3,843 ft.), Ben Lawers (3,984 ft.), and Schiehallion (3,547 ft.).

GRAMPIANS, mountains in Australia, run n. and s. in the w. part of Victoria, stretching in s. lat. from 36° 52′ to 37° 38′, and in e. long. from 142° 25′ to 142° 47′. From their eastern slope flow the Glenelg and its affluents. The loftiest peak of the range, Mt. William, is 4,500 ft. high above the sea.

GRAMPUS (probably from the French, *Grand poisson*, great fish), a cetaceous animal, common in the arctic seas, as on the coasts of Greenland and Spitzbergen, not unfrequent in the Atlantic, and well known on the British coasts. It is one of the *delphinidæ*, or dolphin family, and is commonly referred by naturalists to the same genus with the porpoise, under the names *phocæna orca*, *P. grampus*, and *P. gladiator*, although a new genus, *grampus*, has also been proposed for it. It is the largest of the *delphinidæ*, often more than 20 ft. in length; its form spindle-shaped, but thicker in proportion than the porpoise, from which it also differs in the much greater height of its dorsal fin, in the upper jaw projecting a little over the lower, and in the smaller number of teeth, which are about eleven on each side in each jaw. The tail is powerful; in a specimen 21 ft. long, it was found to be 7 ft. broad. The grampus is generally seen in small herds. It is very voracious, and pursues salmon up the mouths of rivers as far as the tide reaches. Marvelous stories are told of attacks which it makes on the whale, and of its tearing out and devouring the whale's tongue, but even the least improbable require confirmation. The grampus possesses great strength and activity.

GRAN, a co. in n.w. Hungary, on both sides of the Danube and the Gran; 424 sq.m.; pop. '70, 65,306, nearly all Magyars. The soil is for the most part fertile, and the main productions are corn, fruits, and wine. Coal, limestone, and valuable marbles abound. Co. seat, Gran.

GRAN (Mag. *Esztergam*), a t. of Hungary, is finely situated on an elevation on the right bank of the Danube, 25 m. n.w. of Pesth. It is a royal free-town, is the see of the primate of Hungary, has a large cathedral, and is rich in fine buildings. Pop. '69, 8,780. Gran, which is one of the oldest towns of Hungary, was the residence of the Hungarian prince, Gejza; and here his son, St. Stephen, the first king of Hungary, was born in 979, and converted to Christianity in 1000. It was formerly fortified, and has undergone assaults and sieges almost without number.

GRANADA, a province in s. Nicaragua, on the Pacific and Nicaragua lake; 2,943 sq.m.; pop, 56,000. Its surface is for the most part a table-land, gradually descending towards the lake, and more abruptly towards the ocean. The territory is nearly equally divided by a low mountain ridge, in and near which are several active and quiescent volcanoes. Lake Nicaragua is the largest body of water. Minerals are abundant, and there are many mineral springs. Capital, Granada.

GRANADA, a city of Nicaragua in a department of its own name, stands on the n.w. side of lake Nicaragua. It was founded by Hernandez de Cordova in 1522. The number of its inhabitants, including the suburbs and municipality of Jalatava, is about 15,000. Prior to 1854 it was the thriving seat of many commercial establishments. It suffered greatly, however, from the civil war that broke out in the republic during that year, and was under siege from May, 1854, to Feb., 1855; but was bravely and successfully defended by Don Fruto Chamorro, the leader of the conservative party. In 1856, Chamorro having in the meantime died, Granada was surprised and taken by the demo-

crats, but was retaken and almost wholly destroyed in the following year. After the conclusion of peace, efforts were made towards the restoration of the city. It has not yet, however, regained its former prosperity and importance.

GRANA'DA, an ancient kingdom, and one of the old provinces in the s of Spain, was bounded on the w. by Andalusia, on the e. by Murcia, and on the s. and s.e. by the Mediterranean. Its greatest length from n.e. to s.w. was about 210 m., and its greatest breadth about 80 miles. It is now divided into the three modern provinces of Granada, Almeria, and Malaga, the united areas of which amount to 11,063 sq.m., and the united pop., in 1870, to 1,351,909. The surface of this ancient province is mountainous and picturesque in a high degree. The mountain-ranges—the chief of which are the Sierra Nevada, the Sierra de Ronda, and the Alpujarras—as a general rule, run parallel with the coast. The principal rivers are the Almanzora, Almeria, Jenil, Guadalhorce, and Guadiaro, all of which, save the Jenil, an affluent of the Guadalquiver, flow into the Mediterranean. The province of Granada is, on the whole, fruitful and highly cultivated. The mountains are rich in silver, copper, lead, and iron; and many of the inhabitants are engaged in mining and smelting Saline and mineral springs abound. In the time of the Romans, Granada was a portion of the province of Baetica; but after the Arab invasion it formed an independent Moorish kingdom. For a time it was exceedingly wealthy. From the year 1248 the Moorish kings of Granada were obliged to recognize the supremacy of the kings of Castile. A quarrel, however, which arose between the vassal king of Granada and Ferdinand and Isabella in the 15th c., resulted in a war of 11 years' duration, the consequence of which was the complete conquest of Granada by the Spaniards in 1492, and the total destruction of Moorish authority in Spain. The modern province of Granada has an area of 5,030 sq m.; pop. '70, 485,346.

GRANA'DA (Spanish, *Granata*, Arab. *Garnathah,* said to be a corruption of *Karnáttah,* the ancient fortress of Phonician origin), a famous city of Spain, formerly capital of the kingdom of Granada, and now chief town of the modern province of the same name, is built on a northern branch of the Sierra Nevada, at an elevation of 2,445 ft. above sea-level, in lat. 37° 15′ n., long. 3° 45′ w , and is about 140 m. e.s.e. of Seville. It stands on the right bank of the Jenil, overlooking the fertile and extensive *Vega* or plain of Granada, and is watered also by the Darro, a rapid mountain-stream, which joins the Jenil about a mile below the town. Though now sadly decayed, it is still one of the greatest towns of Spain, is the seat of an archbishop, and has a university, attended, it is said, by about 800 students. One of the two hills on which the town is mainly built is surmounted by the Alhambra (q.v.); the other hill is occupied by the suburb called the Albayzin, the oldest part of the town, and now inhabited almost entirely by gypsies. The city of Granada proper, namely, that portion of it that contains the Alhambra, is surrounded by high but ruinous walls, and by strong towers The streets are narrow, crooked, and uneven; the houses, which for the most part are well built, are heavy and gloomy in outward appearance, having the flat roofs and projecting balconies of the Moorish style of architecture; the interiors, however, are convenient and suitable to the climate. Granada has several charming public squares. The cathedral, a splendid structure, profusely decorated with jaspers and colored marbles, and having a high-altar placed under a dome, supported by 22 pillars, contains the monuments of Ferdinand and Isabella, and of Philip I. and his consort Juana. The industry and trade of the town are quite inconsiderable. Pop. 62,000.

The modern city of Granada was founded by the Moors in the 8th c., and for some time remained subject to the caliphs of Cordova; but 1235 it became capital of the kingdom of Granada, and rapidly rose to distinction as a wealthy trading city and as the seat of arts and architecture. Under the Moors, it attained the highest pitch of its prosperity. Toward the close of the 15th c., it is said to have had 400,000 inhabitants, and to have been surrounded by a wall fortified with 1030 towers. The *Vega* of Granada, in front of the city, was celebrated for 200 years as the scene of contest between the Moors and the chivalry of Christendom—a contest which was brought to a termination only by the capture and complete subjection of Granada by Ferdinand and Isabella in 1492, after a siege of 12 months.

GRANADIL'LA, the edible fruit of certain species of passion-flower (q.v.). The name, originally bestowed by Spanish settlers in the West Indies and warm parts of America, is a diminutive of *granada*, a pomegranate. The COMMON GRANADILLA (*passiflora quadrangularis*) is extensively diffused over these regions, and much cultivated. The plant is a luxuriant and very ornamental climber, often employed to form arbors and covered walks; it has large, beautiful, and fragrant flowers; oblong fruit, often 6 in. in diameter, of an agreeable fragrance, and a sweet and slightly acid pulp, very gratefully cooling. It is often eaten with wine and sugar.—The APPLE-FRUITED GRANADILLA, OR SWEET CALABASH (*P. maliformis*), is plentiful in the woods of Jamaica, where it forms a principal part of the food of wild swine. It is, however, a very agreeable fruit, about 2 in. in diameter, its pulp gelatinous, the rind so hard as to be sometimes made into snuff-boxes and toys. The LAUREL-LEAVED GRANADILLA (*P. laurifolia*), sometimes called water-lemon in the West Indies, is a fruit about the size of a hen's egg; the plant has red and violet fragrant flowers, and very long tendrils. The fruit has a whitish pulp, so watery that it is usually sucked through a hole in the rind; it has a delicious

flavor, and a slight acidity. It is much cultivated.—Several kinds of granadilla are occasionally cultivated in hothouses in Britain. In the s. of Europe, they grow in the open air.

GRANARY WEEVIL, another name of the corn weevil (q.v.).

GRANBY, JOHN MANNERS, MARQUIS OF, an English gen., the eldest son of the third duke of Rutland, was b. Jan. 2, 1721. Educated at Eton and Cambridge, he was at an early age elected M.P. for Grantham. In the rebellion of 1745, he raised a regiment of infantry, and accompanied the duke of Cumberland into Scotland. Appointed col. of the Horse Guards in 1755, in Feb., 1759, he received the rank of lieut.gen., and soon after was sent to Germany, as second in command, under lord George Sackville, of the British troops, co-operating with the king of Prussia. After the battle of Minden, for his conduct in which he received the thanks of prince Ferdinand of Brunswick, to the disparagement of his superior officer, who resigned, and was afterwards cashiered, he was appointed commander-in-chief of the British troops, and held that post during the remainder of the seven years' war. He particularly distinguished himself at the battles of Warburg in 1760, of Kirchdenkern in 1761, and of Græbenstein and Homburg in 1762. In 1760, during his absence with the army, he was appointed a member of the privy council. After the peace of 1763 he was constituted master-gen. of the ordnance, and in 1766 commander-in chief of the army. He died Oct. 20, 1770, in his 50th year. Though very popular in his time, as evidenced by the frequency with which his portrait was used as a sign to public-houses, he was the subject of some of the most terrible invectives of Junius; and his military qualities appear to have been much overrated by his contemporaries.

GRAND, in music, is a word synonymous with great—such as grand sonata, grand symphony, overture, or chorus, signifying that the composition is full, and not simple or easy.

GRAND, a co. in n. Colorado, bordering on Wyoming, drained by the North Platte, and South and Green rivers, and including the great table-lands of Middle park and North park. The co. is otherwise mountainous; gold and silver are plentiful; hot and sulphur springs are numerous. Co. seat, Hot Sulphur Springs.

GRAND ALLIANCE, a compact between the Dutch states-general and the emperor of Germany, signed at Vienna, May 12, 1689, afterwards assented to by Spain, England, and the duke of Savoy. The object was to prevent the union of France and Spain in one monarchy.

GRAND BANK, an elevated plateau in the Atlantic ocean, stretching from Newfoundland towards the coast of Europe, and of undefined extent. It is by some scientists supposed to be composed in part of deposits of solid matter brought from the arctic seas by icebergs. The British and French submarine cables lie along this elevation. Near the American coast the grand bank is noted as the favorite resort of codfish.

GRAND CAPE, in English law, the name of the writ whereby in an action of dower, on the failure of the defendant to appear to answer to the summons, a third part of his lands are attached to await the decision of the court. The writ contains an order for the defendant to appear on a day specified. If the defendant do not appear on the return of the writ of grand cape, judgment is given in favor of the widow, who is thereupon entitled to take possession of the lands in satisfaction of her dower.

GRAND-COMBE, LA, a t of France, in the dep. of Gard, 35 m. n.w of Nimes, with which it is connected by railway Near it are some very important collieries, which supply the French steam-navy at Toulon. In the town are oil-mills and glass-works. Pop. '76, 5,342.

GRAND COUTUMIER OF NORMANDY is a collection of the ancient laws of Normandy, and is said to have been compiled in the third year of Henry III. It contains the laws and customs which were in use in England during the reigns of Henry II., Richard I., and John, and such also as were in force in Normandy after the separation of that duchy from England. It is therefore a collection of the laws of Normandy as they stood subsequent to the union with England. The customs of Normandy were to a great extent adopted in England after the conquest; and the laws of this country, particularly during the reigns of the Norman sovereigns, present a great similarity to those of Normandy. Sir M. Hale, jealous for the honor of England, contends that this similarity arose from the introduction of English customs into Normandy. In the rules of descent, of writs, of process, and of trial, the laws of England and Normandy were at first almost identical. It appears from the grand coutumier, that though the verdict of twelve men was always required on a trial by jury, yet in case of a difference of opinion among the original jurors, the minority were set aside and fresh jurors chosen, until twelve men could be found to agree in a verdict. By the custom of Normandy, where a married woman died possessed of land, her husband was entitled to hold the lands, but only while he remained a widower. By the courtesy of England, on the other hand, the widower held the lands for his life. Lands held by knights' service (q.v.) and grand sergeanty (q v.) descended, according to Norman custom, to the eldest son; but lands held on an inferior tenure were divided among the sons. And where a man had

cohabited before marriage with the woman who afterwards became his wife, a son born before marriage inherited the land to the exclusion of children born in wedlock. See Hale's *History of the Common Law.* The islands of Guernsey, Jersey, Alderney, and Sark were originally part of the duchy of Normandy, and were united to the crown of England by the first princes of the Norman line. Though still attached to England, they are governed by the old feudal laws, or coutumier of Normandy. They have their own independent courts; and a writ from the courts at Westminster does not run in these islands. A royal commission under the great seal of course has force, but the commissioners must judge according to the law of the islands. All causes are originally determined by their own officers, the bailiffs and jurats of the island, who administer a code of laws based upon the grand coutumier. From their decision, an appeal lies to the privy council. Acts of the British parliament are not in force in these islands unless they are specially named.

GRAND DAYS were those days in every term solemnly kept in the inns of court and chancery—viz., in Eastern term, Ascension-day; in Trinity term, St. John the Baptist's day; in Michaelmas term, All Saints' day (and of late, All Souls' day); and in Hilary term, the festival of the Purification of our Lady, commonly called Candlemas day; and these are *dies non juridici*, no days in court.—*Cowel.* On these days were formerly held the revels for which the inns of court were famous. The last revel held in the inner temple was on Candlemas day, 1733, on the occasion of Mr. Talbot's elevation to the woolsack. At this feast fourteen students of the inn waited at the benchers' table. After dinner a play was performed by actors, who came full dressed from the Haymarket in chairs, and it is said, refused to receive payment for the honor of the occasion. After dinner, judges, sergeants, and benchers, formed a ring round the stove in the center of the hall, and *danced, or rather walked about the coal fire, according to the old ceremony, three times,* and all the time the *ancient song* was sung by one Toby Aston, dressed in a bar-gown. The prince of Wales, Frederick, father of George III., witnessed this part of the ceremony *incog.* The room was then prepared for dancing, which was kept up, with the pleasing interlude of a splendid supper, until morning. See Pearce's *Inns of Court and Chancery.* Grand days continue to be observed, but they have no longer the solemn character formerly attached to them. Nor are they held on the same days as formerly; for by the alteration in the law terms made by 11 Geo. IV. and 1 Will. IV. c. 70, those days no longer fall within the term. Grand days are now fixed at the pleasure of the benchers. On these days an entertainment is given in hall to the judges who had formerly been members of the inn, and on this occasion an additional bottle of wine is supplied to every mess of four men among the barristers and students. On circuits, also, the circuit bar appoints a special day for the grand day, on which, after dinner, the various matters of social interest affecting the circuit are discussed and settled.

END OF VOLUME VI.